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ON THE COVER: Ali Machinchy's Elite Aerosports Shockwave in knife-edge flight during Florida Jets. (Photo by David Vaught)

THIS PAGE: Franco Di Mauro's Rafale puts on a show during Florida Jets. (Photo by David Hart)

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Preflight

BY DEBRA CLEGHORN | EXECUTIVE EDITOR

Road to Top Gun

Here at *Model Airplane News*, we like to get the scale party started a little early! Every year, a few months before the big Top Gun Invitational Tournament in Lakeland, Florida, we ask competitors to give us the inside scoop on the planes they are working on, modifying, and setting up for the upcoming scale shootout.

Some of these planes are brand-new projects, while others are old favorites that we love to see fly. This year is no different, and we have a collection of incredible scale airplanes that will all be flying and competing at this year's event. If you've never attended this world-class event hosted by Frank Tiano, it's well worth the trip. Scheduled for May 3–7, 2017, Top Gun attracts the best pilots and planes from around the globe, and *Model Airplane News* is proud to be a major sponsor. If you go, you're sure to see the *Model Airplane News* crew on the flightline, and I hope that you'll stop by to say hi. For directions, times, and hotel information, go to franktiano.com. If you aren't able to attend in person, be sure to visit ModelAirplaneNews.com and our Facebook page for the latest happenings at the competition.

New to RC model airplanes? This month, we have step-by-step instructions for installing your engine and radio gear in an almost-ready-to-fly model. If you're building more advanced models from kits or plans, you won't want to miss our workshop how-to on installing giant-scale electric retracts. (It isn't as complicated as it seems!) Moving to the field, we have the inside track on how to improve your flying in David Scott's "Winning Habits: Pro Advice for Better Flights." We also have easy-to-follow instructions on flying a knife-edge pass and some impressive variations (be sure to try these two—or even three—mistakes high!).

Just as it has been for more than eight decades, *Model Airplane News* is your magazine, and we appreciate your feedback and suggestions. Why not drop us a line at MAN@airage.com or leave a post on our Facebook page? We hope to hear from you soon.

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YOUR FEEDBACK

We love hearing from our readers: Your emails, tweets, and comments quickly let us know what you'd like to see more (or less!) of in upcoming issues and online. Here's what some of you are saying about *Model Airplane News* magazine.

Facebook

Photo of the Week

Continuing to be some of our most popular posts, our Photo of the Week never fails to draw your attention. This most recent one, by David Hart, was taken at the 12 O'Clock High event at Paradise Field in Lakeland, Florida, and as we said, "It happens!" You guys also shared your thoughts and comments.

AM: *Ouch! That's not going to buff out.*

CAH: *Some people ask how I can spend $300 plus on an airplane when it's gone with one mistake. "The crash is worth it; every flight is a plus!"*

JM: *I made a high-speed pass through a tree last weekend.*

BS: *Just remember—there are two types of RC planes: those that have crashed and those that are going to crash.*

PF: *A good rule of thumb: If you can't afford to lose it, don't fly it. If you're not going to fly it, don't build it.*

GE: *I see the problem—no pilot figure!*

In Our Mailbox Camel Colors

I have been looking for the guy you wrote about who had a beautiful 1/3-scale Sopwith Camel at the 2015 Top Gun Invitational Tournament. He did an amazing job. I've looked everywhere for information, including your older article on the "Road to Top Gun." I am wondering if he used the standard PC-10 or the lesser used PC-12 color for the top surfaces. Let me know if you can find out what he used. I am building a Camel now, and I would love to duplicate his finish.—*Paul "Limey" Rice*

Thanks for writing. The guy you are talking about is our good friend and Long Island Skyhawks member Mike Gross Sr. Mike did very well at Top Gun with his British dogfighter. He built it from Mick Reeves' plans. The paint was Klass Kote epoxy mixed to match FS 30051 to approximate the color of PC-12, also described as "Hersey Chocolate."—GY

ModelAirplaneNews.com

Weathering a Corsair

No doubt about it, among warbirds, the Vought F4U Corsair ranks way up near the top as a favorite with modelers. With molded warbirds like the Tower Hobbies Corsair, they all just sort of look just like the next one. You can always do an entire new paint job, but another way to make your bent-wing warbird stand out is to weather it. By adding some wear and tear here and there and a little dirt and grime, the effect elevates your everyday fighter to the next level of realism. Rich Uravitch shows us the techniques he employed, and they are relatively easy and inexpensive. You guys had plenty to comment on as well.

Dr. Major King: *Nicely done, and thanks for sharing your technique.*

Bruce Gale: *Rich, thank you for this awesome article with fairly simple techniques. The pictures and explanations are great.*

R. Michael Clarey: *Good stuff to know about. Thanks for sharing.*

Nigel Rollason: *I always like to start with the cockpit, from a stand-off point of view, and with a pilot that doesn't look like a child's doll!*

Tim Stone: *Thanks, Rich. Nice stuff. This technique is used a lot on plastic static airplanes. Even if you are not into them, most people over the winter can learn a lot by trying to build, paint, and weather/wear a static model. I know I did.*

Milly: *Now that's subtle! Great technique.*

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Tips&Tricks

USEFUL HINTS FROM MODELERS | Illustrations by Richard Thompson

CLOG-FREE TIPS

When you use instant CA glue, the tips often clog easily. To avoid this, add some acetone to a recycled glass jar and drop in the clogged applicator tips; the next day, they'll be cleared of the clogged glue. Keep several applicator tips on hand to exchange and place into the acetone jar. Tightly screw the lid on the jar to prevent evaporation, and use long-nose pliers to grab the clean applicator tip to keep your fingers out of the acetone.

Edwin Hawk, Smithville, OH

HANDY WING WEIGHTS

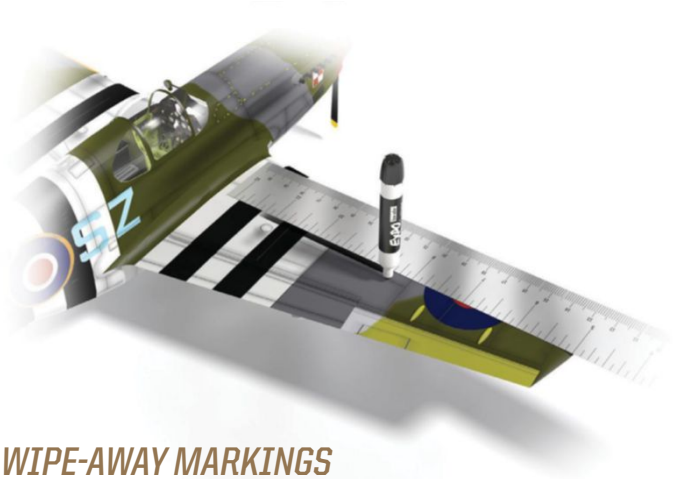
When you hold wing sheeting in place while the glue sets, weighted bags can make dents between the ribs. Instead, stack old magazines on the wing. The magazines bend in one direction and never leave dents, no matter how many you use.

Lou Cetrangelo, Saint James, NY

LONG-DISTANCE BINDING

When it comes time to bind an airplane to a transmitter, it is often hard to plug the binding plug into the receiver. There's usually a rat's nest of wiring, and if you have wrapped your receiver (located at the bottom of the RC compartment) in foam to protect it from vibration, it all has to come out. Make it easier by plugging a servo extension cable into the receiver binding port and routing it through a small hole in the side of the fuselage. You can now easily plug in the binding plug while the wing stays in place.

Bob Aberle, Hauppauge, NY



WIPE-AWAY MARKINGS

When balancing a molded form plane or even a plastic film-covered model, use a Sanford Expo dry-erase marker to mark the center of gravity on the wing and let it dry. When you are done balancing the model, simply wipe the marked area with a dry cloth or paper towel and the marks will completely disappear. They can also be used for positioning decals, stripes, and anything that needs some temporary guide marks.

John Nelson, Milton, WI

SEND IN YOUR IDEAS! We want your ideas for Tips & Tricks! This month's winners will receive a *Model Airplane News* baseball cap. Send a photo or rough sketch and a brief description to MAN@airage.com or *Model Airplane News*, c/o Air Age Media, 88 Danbury Rd., Wilton, CT 06897 USA.

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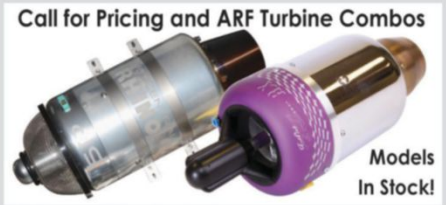


Pilot Projects

SHOWCASING WHAT YOU BUILD & FLY | Email entries to: MAN@airage.com

PILOT PROJECT OF THE MONTH

Ju 87 Stuka

Jon Seese, Madison, WI

After building this 100-inch-span model from Ziroli plans, Jon powered it with a Hacker Q80 electric motor, Jeti speed control, and a 10S 5400mAh Thunder Power battery pack. Painted using WarbirdColors paint with getstencils.com markings, this warbird has a full cockpit and sliding canopies as well as working navigation and landing lights.

Grumman Widgeon

Andre Wedseltoft, Sundridge, ON, Canada

This scratch-built Grumman Widgeon is from the old Irwin Ohlsson design. The 80-inch-span model is powered by a pair of 700-watt outrunners and has a fiberglass and painted fuselage with a MonoKote-covered wing. It has differential thrust for very positive taxiing control.

Supermarine Spitfire

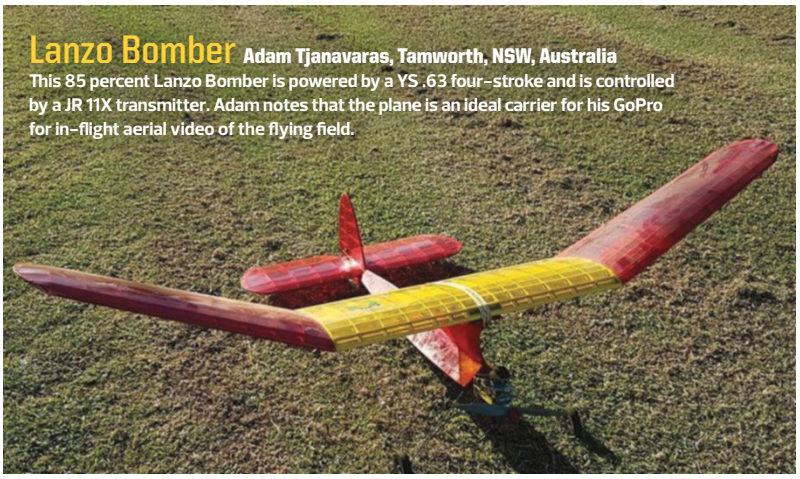
Ron Leyk, Elk Point, AB, Canada

Ron writes that he and his friend Art Fuller enlarged plans for a 40-inch-span model to build this nearly 12-foot-span monster! Made out of foam, the big plane weighs just 16 1/4 pounds and is powered by a Zenoah 38cc gas engine.

Lanzo Bomber

Adam Tjanavaras, Tamworth, NSW, Australia

This 85 percent Lanzo Bomber is powered by a YS .63 four-stroke and is controlled by a JR 11X transmitter. Adam notes that the plane is an ideal carrier for his GoPro for in-flight aerial video of the flying field.



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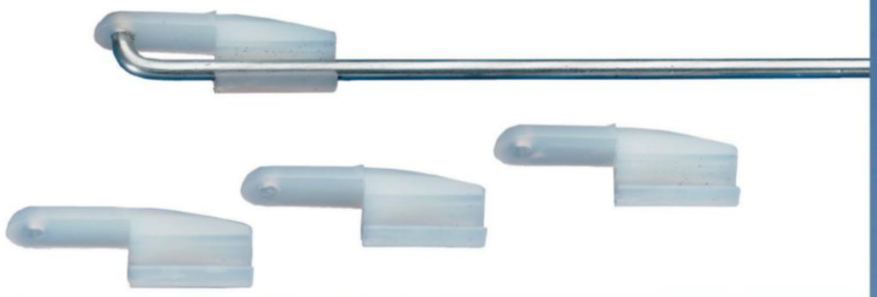

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Amimon Falcore

This new quad racer is designed for new pilots looking to get into drone racing and has a mode in which it will automatically fly 1 meter from the ground without crashing. The Falcore's arms are easy to disassemble along with the antenna, so the racer can be packed in a small bundle. The carbon-fiber tubular frame protects all the electronic components, and the flexible motor-arm joints are designed to come apart in the event of a high-speed impact. Assembly only takes a few minutes and requires no tools. Priced at $799.00, the Amimon Falcore comes with everything you need except goggles. **amimon.com**

Hitec D-Series Servos

These programmable servos offer a wide range of voltage capabilities, high resolution, rapid response, and SmartSense technology. The members of this particular D-Series group are all designed with extremely durable titanium gears; and the red D941TW, D946TW, and D951TW trio boast full-metal cases. They start at $147.99 each. **hitecrcd.com**

E-flite Carbon-Z Cessna 150 2.1m

With scale features like LED lights, fully functional flaps, wheel pants, and a shock-absorbing nose strut, this great-flying giant model can do it all. (It can even fly off water with optional floats!) The wing halves and struts can be removed for transport without using any tools, and the model's Hands-Free Servo Connection System makes field assembly easy. The 83.7-inch-span Cessna comes with a brushless power system and servos installed. The Plug-N-Play version is $379.99; the Bind-N-Fly (BNF) Basic version is $399.99. **e-fliterc.com**

Duratrax **32-Tip Multi-Driver**

You can stop borrowing everyone else's tools at the field with this anodized-aluminum super tool! It works with the hardware fasteners most commonly found in popular RC drones and park fliers. Its handle conveniently holds 15 short-shank, double-tip bits, with a bit stored in the "in use" position. Sizes are clearly marked on all bits, which provide a wide selection of tips for slotted, hex, Phillips, Pozidriv, and Torx (or "star") heads. Rotate the endcap of the handle to remove the bit you need. Added bonus: The handle's shape prevents it from rolling away when not in use. The Multi-Driver costs $24.99. **duratrax.com**

Blade
Torrent 110 FPV

This pocket-size racer has propeller guards to make it safe to fly inside, while high-torque brushless motors give it the authority to handle outdoor flight and epic freestyle maneuvers in any environment. It features a 2mm carbon-fiber frame and a Betaflight-configurable F3 flight controller, and it comes out of the box professionally tuned. Just add a 3S 450mAh battery and bind it to your compatible Spektrum transmitter. This BNF Basic racer costs $199.99. **bladehelis.com**

Dynamite
Prophet Sport Duo 50W

This rugged, portable, AC-powered charger can power up two LiPo or NiMH batteries at once—and the batteries can have different chemistries, capacities, and cell counts! Its high-visibility, simplified user interface has two four-digit LED indicators to display charge current, battery type, charge capacity, cell voltages, and error codes. The Sport Duo 50W costs $99.99. **dynamiterc.com**

ICARE **Graecalis 3.0**

Developed in Italy for unlimited and unrestricted aerobatic flying, this scale glider is also a great ship for aerotowing. Molded fiberglass/epoxy and carbon-fiber versions are available, and the glider features live-hinged "elastoflap" ailerons and flaps. Available in five colors, the Graecalis 3.0 starts at $1,169.00. **icare-icarus.com**

THE ROAD TO TOP GUN

A sneak peek of the planes and pilots competing at this year's scale invitational

BY **GERRY YARRISH**

Wow! It's hard to believe, but it's that time again. The 2017 Top Gun Scale Invitational is just around the corner, and so we are ready to start highlighting some of the newest contestants planning to compete at Paradise Field in Lakeland, Florida. Hosted by Frank Tiano, this year's competition starts on May 1 and continues through the 7th. As always, our "Road to Top Gun" article and online posts help heat up the excitement by showcasing many of the amazing aircraft and their pilots, all of whom are hoping to earn the title of "Mr. Top Gun." If you'd like to attend this year's scale invitational, you can get all the details at franktiano.com. This event is well worth the trip!

Rogerio Araujo's
Brazilian P-47 Thunderbolt

Our good friend and Brazilian flying buddy Rogerio Araujo is coming to Top Gun with a new entry this year. From the aerospace city of São José dos Campos, São Paulo, Rogerio will have his P-47 Thunderbolt dressed up in Brazilian Air Force colors. Used in the European Theater of Operations in Italy, 1944–45, this particular plane was flown by Alberto Torres, the most experienced Brazilian pilot of World War II with some 100 missions.

Powered by a DLE 55cc gas engine, Rogerio's model is based on the Top Flite giant-scale ARF, and it has been upgraded with an all-painted finish using Tamiya paint (that's a lot of those little bottles). The Thunderbolt also has electric retracts, and Rogerio says that it flies like a dream. Born in Rio de Janeiro, Rogerio started in the hobby in 1968 with a rubber-band "Paulistinha" free-flight model. Rogerio stuck with these simple models and flew up to 2m-span gliders until 1978, then he moved into control line.

The Brazilian champion at the MiniFair in 1989, Rogerio has earned several other top titles flying at several local events. In 1992, he started flying RC and, in 1998, became devoted solely to scale. His biggest goal had always been to become an accomplished Top Gun competitor. This is the fourth time he has competed in the Pro-Am Sportsman class.

Rogerio Araujo shows off his impressive Brazilian bubbletop P-47 Thunderbolt.

Caught at sunset, Walt Alexander's big Fokker D.VII sits quietly on the Top Gun runway after a full day of flying.

Walter Alexander's
Family Affair

From Decatur, Tennessee, Walter Alexander will be flying his 1/3-scale Fokker D.VII in the Pro-Am Sportsman class at Top Gun. Walt's aircraft is modeled after Carl Degelow's aircraft from WW I. Built from a Balsa USA 1/3-scale kit, it has a 118-inch span and weighs in at 38 pounds. Walt chose a Zenoah GT80 twin-cylinder gas engine for power and uses a Hitec Optic 6 transmitter with Hitec HS-645MG servos. The Fokker D.VII is covered with Coverite and painted in the Degelow scheme using PPG paints; the lozenge pattern and aircraft markings are all custom-painted. The model was fully fitted with RC hardware, all from Balsa USA, and the cockpit was dressed up with homemade details using common shop materials.

Walt's daughter Ellie shows off her Piper Cub.

Walt readies his big Fokker D.VII while his spotter and son Nick assists at Top Gun 2016.

Walt's family has been building and flying for multiple generations, since the 1970s. Starting with a RealFlight simulator, Walt's children Nick and Ellie started learning to fly RC. Walt and the boys had been attending Top Gun and Joe Nall, but at the family's first Youth Masters event, interest for the girls started to grow. After learning to fly the simulators, Walt's kids move to RA Cores electric airplanes and .40-/.60-size nitro planes and are now more interested in scale flying. As Ellie and Nick pursue Top Gun, it was interesting to see them navigate toward building their version of Piper Cubs.

Nick was Walt's spotter at last year's Top Gun and learned how the event worked. He was then interviewed by Frank Tiano to obtain his invitation. Nick's airplane is a 1/4-scale Piper NE-1, which was the military version of the J-3 Cub. Walt also asked for an invitation for his daughter Ellie. She is bringing a 1/4-scale Piper Cub J-3. Both Nick's and Ellie's Piper projects are built from Balsa USA kits and have 108-inch wingspans. Each will be powered by DLE 30cc gas engines turning Falcon 18x8 Civilian propellers. Both will have a Hitec Optic 6 Sport radio system with Hitec HS-645MG servos. The covering will be Solartex from Balsa USA, and the planes will have PPG paint and decals from Kirbys Kustom Vinyl Graphics. The airplanes will also have scale cockpit details from Dynamic Balsa kits. Various other accessories, like wheels, fuel tank, and pushrods, come from Tower Hobbies.

Steve Thomas's Fokker Dr.I Triplane

This year will be Steve Thomas's 14th trip to Top Gun as a competitor, and this year, he will be flying his new Fokker Triplane. Owner of Bob's Hobby Center in St. Cloud, Florida, he has no excuse for not having the right parts and accessories on hand when he needs them! Competing in the Pro-Am Sportsman class, Steve purchased a wrecked Glenn Torrance Models 1/3-scale model and spent many long hours repairing, restoring, and enhancing it. Recently competing at The Blue Max WW I event, Steve put in plenty of stick time getting the Triplane back into flying trim. The Triplane has a 95-inch span and is 76 inches long. It weighs 44 pounds and is powered by a DLE 100cc twin-cylinder gas engine turning a Xoar 30x6 German Axial-style propeller. Steve is using a Jeti DS-16 radio and he has added a Bavarian Demon Gyro.

Steve painted his model to replicate the airplane flown by Paul Bäumer ("The Iron Eagle"), famous for his 42 kills while flying with the Jasta Boelcke 204/17.

Gabriel Pellegrini's F-100 Super Sabre

Competing again for the third time at Top Gun this year, Brazil's Gabriel Pellegrini will be flying his well-proven and beautifully executed F-100 Super Sabre in the Pro-Am Sportsman class. The turbine jet is from Bob Violett Models and is 1/6.75 scale. It has a K-210 turbine engine and a dry weight of 42 pounds. It uses 21 servos and electronic valves, and Gabriel uses 16 channels plus a Matchbox to control all the radio gear. The F-100 has a working canopy, a drogue parachute, working wing slats, and a simulated afterburner. His radio is a Futaba 18MZ, and Gabriel uses JR servos throughout. The jet was built by Patrick Frost in the United States, and Gabriel bought it before its maiden flight.

Above: Coming over the top of a loop with smoke on, Robert Russ's Pitts looks just like the full-size aerobatic biplane.
Below: Jacquie Warda, the previous owner of the full-size Pitts, checks out Robert's 46% scale copy.

Robert Russ's
46% Pitts Special

Who says Top Gun is only for warbirds? This 46% Pitts Special, called "The Red Eagle," is the handy work of Robert Russ from Center Hill, Florida, and it is certainly not just a "target"! Competing in the Expert class, Robert built the big Pitts from an EMHW S1-S kit and turned it into a S1-T. Powered by a Valach 170cc four-stroke twin-cylinder gas engine, the Pitts is controlled with a Futaba T8FG transmitter with a Futaba R6014HS receiver. The servos are Savox SC-0251, and the batteries are Li-Ion from Fromeco. A Smart-Fly PowerExpander Competition Plus and a Sullivan SkyWriter Smoke System are also included.

The covering and paint is all from Stits Lite, and the logos were custom made by Decal It. The vinyl wing masking material was cut at a local shop. The propellers used are a Fiala 2-blade wood prop and a Biela 3-blade carbon-fiber propeller. One of the photos shows Jacquie Warda, the previous owner of the full-scale Pitts; the red Extra in the background is Jacquie's current ride. The 46% Red Eagle took one year to build. Most of the exterior items are homemade; the forward-fuselage panels are made out of aluminum sheeting; the antenna is from brass tubing; and the fuel caps are a mixture of brass sheet, brass tubing, and piano wire. The landing-gear covers are made out of PETG, heated and wrap formed. Robert molded the canopy himself, and it took two 4 x 8-foot sheets of clear plastic to get one correctly vacuum formed. The sliding canopy mechanism is a mixture of furniture-drawer slides and composite-sheet material.

Robert comments that it took a year of eight- to 10-hour days, five days a week, to build his plane, but in the end, the Pitts turned out to be an absolute joy to fly.

Eduardo Esteves's F-16C Falcon

A Top Gun competitor for many years, Eduardo Esteves of Lakeland, Florida, has always been a smooth and consistent flier, and he has won many awards for his amazing aircraft. This year, Eduardo is competing in the X class, requiring an airplane that comes out of the box assembled and finished from the manufacturer. X class competitors cannot modify the airframes in any way, but they can enhance the aircraft with weathering. Eduardo will be flying his BVM F-16C, which is powered by a KingTech 210 turbine engine. Using a Mercury PowerBox System and a Spektrum DX18 transmitter for guidance, the F-16C weighs 46 pounds plus fuel. It has a wingspan of 80 inches and is 120 inches long.

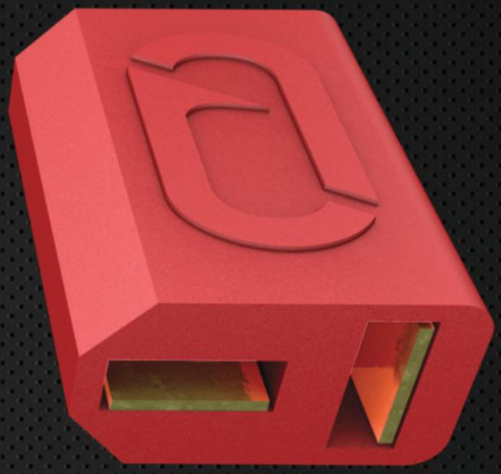
Eduardo will also be competing in the Pro-Am Pro Prop category, with his impressive 1/4-scale P-47 Razorback. Built from a CARF-Models kit, Eduardo's Thunderbolt has a 110-inch wingspan and is powered by a Moki 250cc radial engine turning a Solo prop. Built by Denny DeWeese, the P-47 has JR servos, Sierra retracts, and a Klass Kote finish. Eduardo has more than 210 flights on the big Jug.

Will Berninger's T-34C Mentor

Competing for his second time at Top Gun, Will Berninger will be flying in the Pro-Am Pro Prop class with his 117-inch Raytheon (Beechcraft) T-34C Mentor. Will purchased the T-34C in 2014 from champion scale builder and flier Mike Barbee of Columbus, Ohio. Will competed with it at the 2014 Scale Nationals and finished first in the Open AMA class. He also went to the U.S. Scale Masters in October 2014 and finished second overall in the Pro-Am Pro class.

Powered by a 3W 110cc inline twin-cylinder engine and using a Futaba 18MZ radio system with Futaba 9157, 9152, and 9153 servos, the model has functional flaps and retractable landing gear and features a fully detailed cockpit interior. Will and Mike have been flying models together for many years, spanning back to the 1980s. Will commented that Mike and another good friend, John Boyko, have always encouraged him to fly competitive scale with them.

Will Berninger poses with his impressive T-34C Mentor.



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Bret Becker's

North American XB-70 Valkyrie

Intended to be the ultimate deep-penetration nuclear-equipped strategic bomber, the North American Aviation XB-70 Valkyrie looks like it jumped off the pages of a Buck Rogers pulp-fiction comic book. The six-engine bomber was capable of reaching speeds in excess of Mach 3 while flying at an altitude of 70,000 feet. The XB-70's maiden flight was on September 21, 1964, and it first flew supersonic on its third test flight on October 12, 1964. What a great subject for a Top Gun aircraft, and Bret Becker thought he'd give it a try. Since learning to fly in the early '90s, Bret has dreamed of competing at Top Gun. So this year, he is very excited to cross that off his bucket list, and he plans to get his feet wet competing in the Pro-Am Sportsman class.

Originally from Los Angeles, California, Bret and his fiancée, Wency, have been living in Dayton, Ohio, for the past two years. He was blown away by the XB-70's presence, seeing it for the first time in the National Museum of the U.S. Air Force in Dayton. He had been planning to build one from scratch and reached out to his friend and fellow modeler Ray Cannon of Hemet, California, for advice. Ray had built an XB-70 in 2001 and had limited success with the model. It spent many years in his basement after sustaining flight damage, and Ray had lost motivation. Bret was able to acquire the model and spent the past year restoring it to flight condition.

The construction is of conventional balsa and ply with a painted fiberglass finish. The XB-70 is 8 feet long and has a wingspan of 56 inches. Weighing 25 pounds, it is powered by four Schubeler HDS-30 (70mm) EDF units, using 1540-9 Tenshock motors. YEP 80-amp speed controls and one 6S 4500mAh LiPo pack are used for each fan. Robart 550 Series retractable landing gear are used, and Bert chose a Futaba 14-channel radio system for guidance.

Shot from inside the museum, Bret Becker and his fiancée, Wency, pose with the full-size Valkyrie in the background. (Photo by Victoria Thomas)

Many hours of workshop time went into the resurrection of the XB-70.

Bret poses with his completed model in front of the National Museum of the U.S. Air Force in Dayton, Ohio.

Honoring the 75th Anniversary of the P-51 Mustang

Legal Tender, Limited-Edition Coin

When I saw Mustangs over Berlin, I knew the War was Lost.

—Hermann Goering, Luftwaffe Supreme Commander

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Brian Blois's
F-16C Fighting Falcon

Flying since he was 10, Brian Blois from Winter Park, Colorado, will be competing for the first time at Top Gun and will fly his BVM PNP F-16C in the X class. The 1/6-scale Falcon is painted in the Alaska Air National Guard Aggressor scheme, and Brian believes it's a perfect candidate for competition. Enjoying many different segments of the hobby and having flown 3D, freestyle, IMAC, and pattern, Brian's true love is now giant-scale warbirds and turbine jets.

The F-16C is powered by a KingTech 210G turbine and has a Spektrum radio system and an E3 gyro. The F-16 weighs 35 pounds with full ordinance and is equipped with navigational beacons, strobes, and landing lights. Brian uses a Spektrum DX18G2 transmitter. A plug-and-play that comes already painted and finished, the model required only about 12 to 15 hours of radio and turbine installation work to complete.

Brian says he flies all across the state of Colorado at elevations ranging from 5,000 to 8,500 feet, and he lives close to 9,000 feet above sea level. Brian often travels to lower elevations around the state to compete at local contests, attend fun-flys, and help new turbine pilots obtain their waivers. Brian is excited and proud to stand next to and fly with some of the best RC scale pilots in the world.

Greg Foushi smiles as he shows off his F-16C Falcon painted in the 122nd Fighter Wing colors of the Indiana Air National Guard.

Greg Foushi's
F-16C Falcon

From Rockledge, Florida, Greg Foushi will be competing in the X class with his impressive F-16C Falcon. The 1/5-scale F-16C is from BVM, is 96.5 inches long, and has a wingspan of 65.5 inches including the missile rails. Power comes from a KingTech 210 turbine, and the servos are all from JR and use an XBus receiver. Painted in the colors of the 122nd Fighter Wing of the Indiana Air National Guard, the Falcon weighs in at 38 pounds. Greg uses a JR 28X transmitter to control his jet. He has been competing at Top Gun since 2009, and was the 2011 Pro-Am Sportsman class champion.

The 122nd Fighter Wing is stationed at the Fort Wayne Air National Guard Station in Fort Wayne, Indiana. If activated, the wing is gained by the U. S. Air Force Air Combat Command.

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Vince Veltri's
Westland Lysander

Competing this year in the Pro-Am Sportsman class, Vince Veltri will be flying for the 14th time at Top Gun with his 1/5-scale Westland Lysander, and he says that he can't wait to compete again. He's not 100 percent sure, but Vince thinks he'll be the oldest pilot there at the age of 81!

Built from the Seagull Models ARF kit, the Lysander has a 118-inch wingspan and weighs in at 30 pounds. Covered with painted Oracover, the Lysander has a semimatte finish that looks very scale. Vince is using a JR 12X radio system, and he is powering his observation/scout plane with a Saito FG-60R3 3-cylinder four-stroke radial engine.

Vince says that he learned about this impressive ARF warbird while surfing on the RC Scale Builder forum. His airplane's maiden flight is still about two weeks away and he's going over everything closely as the center of gravity location looks off! Fortunately, he has a good friend and neighbor who knows quite a bit about these type of airplanes; his name is Nick Ziroli Sr.

The full-size aircraft was used extensively by the French in WW II to pick up downed pilots behind enemy lines, mostly after dark. It can be said that it was the forerunner of today's STOL aircraft, and it was also fitted with bombs and gun pods at various times.

Chuck Hamilton is rightfully pleased with his beautiful Douglas SBD-3 Dauntless. Each of his airplanes has a tie back to his father, and this one built from Ziroli plans is no exception.

Chuck Hamilton's
Douglas SBD-3 Dauntless Dive-Bomber

From Bremen, Indiana, Chuck Hamilton will be competing for the first time at the Top Gun Scale Invitational with his beautiful SBD-3 Dauntless. And he says that he's been preparing himself since he got back into the hobby 15 years ago.

Every model he has built in some way is tied to his father, and this Ziroli Dauntless is no exception. Chuck and his father, Lloyd Hamilton, were at the Air Zoo in Kalamazoo, Michigan, when the museum brought in the original aircraft that this model is based on. While looking over the newly acquired SBD (which was recovered from Lake Michigan, with all the lake growth still attached), his father told him the story of his best friend being a rear gunner on an SBD during WW II.

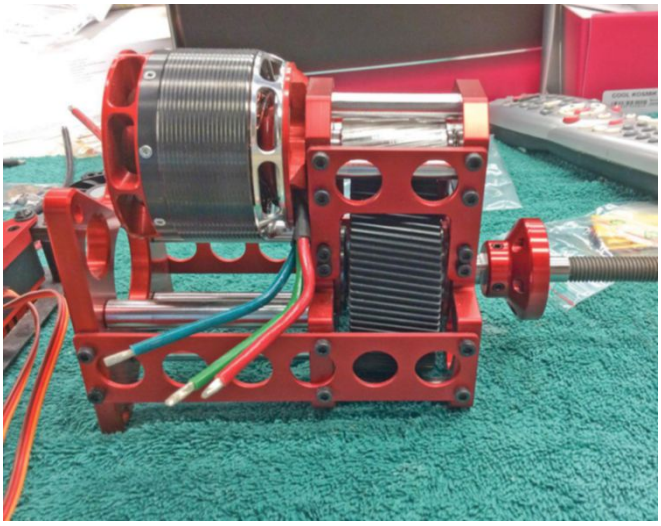
Chuck's SBD has typical wood construction and is nicely powered by a Zenoah GT80 twin-cylinder gas engine. The model is 2.4-inches-to-the-foot scale and has a wingspan of 100 inches. It is 78 inches long and has 1,750 square inches of wing area. It features Robart retracts, a Spektrum DX18 radio system for guidance, and a fully detailed cockpit. The model is painted with latex house paint, including all the markings and weathering. Chuck has been flying the model at local fly-ins now for more than three years. He says that modeling goes back to his father, who was involved in the infancy of the RC hobby, and that their love for scale military aircraft has kept them close. (Photos by Chuck Hamilton and Dino DiGiorgio)

Mike Barbee is coming to Top Gun with a very big electric-powered aircraft: the King Air C-90. His 1/4-scale twin has a 155-inch wingspan.

Mike Barbee's
King Air C-90

If you've thought that electric-powered airplanes aren't all that exciting, wait until you get a load of Mike Barbee's latest Top Gun entry: the King Air C-90 twin. Teaming up with Frank Noll as pilot, Mike will be competing with the King Air C-90 in the Team class. The 1/4-scale King Air twin is built from a Bob Patton design, has an impressive 155-inch wingspan, and is 110 inches long.

The retractable landing gear are air powered and of Mike's own design. Power for the C-90 comes from a pair of geared electric Kontronik motors, matched up with dual 200-amp Kontronik speed controls. The 3-blade propellers are from Vario and are ground adjustable for pitch. Flight testing will begin with 21 5/16 pitch to start. The fuselage is molded fiberglass, and the wings have foam cores that are sheeted. The paint job is definitely military (the only one painted these colors), and it's the Navy Military Heritage scheme.



The C-90 is powered by two of these geared Kontronik brushless outrunner motors.

Up on some maintenance stands, the in-progress C-90 takes up a lot of room in Mike's workshop.

This will be Mike's 27th year attending Top Gun, and during that time, he has entered 10 different airplanes. Mike has been flying RC for 37 years and specifically the past 30 with scale aircraft. Mike is the president of the National Association of Scale Aeromodelers, the special-interest group of the Academy of Model Aeronautics, and it supports and promotes RC scale, control line, free flight, and helicopters. Mike is also the East Coast chairman of the U.S. Scale Masters Association. Mike will also be flying in the Expert class with his big Grumman FM-2 Wildcat.

Mike Gatwood's
Convair CV-440/VT-29B

From Slidell, Louisiana, Mike Gatwood will be competing at Top Gun this year with his beautiful Convair CV-440, also referred to as the VT-29B. A member of Slidell's North Shore R.C. Club, Mike has been in the hobby for 12 years. Built from Don Smith plans, Mike's Convair is a traditional build with balsa ribs and light-plywood formers, all produced by Kit Cutters Inc., and the entire build took three years to complete. The model is finished with fiberglass and resin applied over built-up balsa, and the pneumatic landing-gear system is from Century Jet Models. The aluminum wheels are from Robart.

The aircraft is controlled by a Futaba radio system, and it includes 3-6.6V LiFe 2100mAh batteries (one for the receiver and one for each of two ignitions). The engines are DLE 35cc gassers equipped with Morpower 3-blade, adjustable propellers. The paint job uses Behr Premium plus Rust-Oleum Ultra Cover Satin Clear. Foil tape is used for the polished aluminum panels individually applied in 2 X 4 inch panels. The takeoff weight is 49 pounds.

The photo shows Mike and Leland "Red" Shores, the crew chief for the full-size aircraft (number 51-7909). Red worked on the aircraft from 1958 to 1959 and provided Mike a letter of authenticity for his model.

Jamie Fiffles's
Chance Vought F4U Corsair

Making his trek again from Los Angeles, California, to Lakeland, Florida, Jamie Fiffles will be flying in the Expert class with his impressive 1/4-scale F4U Corsair. Spanning 122 inches, the bent-wing warbird is scratch-built from Don Smith plans. Jamie's aircraft is of all-wood construction, has a fiberglass and resin finish, and is impressively detailed with rivets and panel lines. The Corsair is powered with a Moki 250cc radial engine, and it features a smoke system, landing lights, sequencing landing-gear doors, and a fully detailed cockpit and pilot. It also features a powered functional canopy.

The Corsair is done in the Chico Freeman "LA City Limits" paint scheme, from the VF-17 Jolly Rogers squadron from the fall of 1943. Jamie's Corsair has appeared at many West Coast events, including Warbirds over the Rockies, the Castle Air Force Base Giant-Scale Fly-In, and all of the Southern California events.

Jamie Fiffles strikes a serious pose on the flightline with his mighty Corsair.

Posing with his wife, Luanna, Fernando Bellegarde poses with his impressive Mitchell bomber.

Fernando Bellegarde's
Mitchell PBJ-1J

From São Paulo, Fernando Bellegarde will be competing for the fourth time at Top Gun with his Mitchell PBJ-1J. Built from Ziroli B-25 plans and enlarged to a 118-inch wingspan, Fernando will be flying his U.S. Navy/Marines PBJ-1J in the Pro-Am Sportsman class. Using two DLE 40cc gas engines for power, the PBJ has Robart retracts and Sierra scale wheels, and carries 22 servos aboard. It has functional flaps, bomb-bay doors, a SkyCandy lighting system, and a scale Warbird Pilots crew. It took Fernando four years to finish his amazing medium bomber.

The PBJ-1J was the U.S. Navy version of the Mitchell B-25 medium bomber used by the U.S. Army Air Force in WW II. A few months after the famous Doolittle Raiders bombed Tokyo, the Navy incorporated 40 of the planes and used them as patrol bombers. Fernando belongs to the Brazil Scale Team, whose members all have strong building and flying skills. Fernando is now the scale director for COBRA, the Brazilian federation for modeling, similar to the AMA.

Fernando's Mitchell bomber is detailed inside and out. Here the fully detailed cockpit is complete with two pilot figures from Warbird Pilots.

Dean Copeland's
L-39 Albatros

Coming from Omaha, Nebraska, Dean Copeland will be flying his impressive Aero L-39 Albatros. This will be Dean's 10th year competing at Top Gun and his first year flying a jet in the Pro Jet class.

The plane is a BVM 1/5-scale L-39 Albatros, with a wingspan of 74 inches and a length of 94 inches. The Albatros is powered by a KingTech 140 turbine engine equipped with smoke system, and it has a 47.5-pound takeoff weight. The plane is painted in the scheme of the Black Diamond Jet Team (which is based at the Lakeland Linder Regional Airport adjacent to Paradise Field), and Dean is still in the process of finishing and detailing the pilot and maintenance nomenclature. Dean is a Team Futaba member and uses a Futaba 18MZ radio system.

Roger Niolet's Nieuport 28 C.1

Involved with RC nearly all of his life, Roger Niolet, from Sarasota, Florida, has flown RC airplanes competitively for the last 10 years. This year, Roger will again be flying his Nieuport 28 C.1 as a Team Scale entry. The builder of the Nieuport is David Barry, who worked hard to build and modify some of the details to enter this world-class event. Built from a Balsa USA 1/4-scale kit, the airplane is modeled after the aircraft flown during WW I by Capt. Eddie Rickenbacker. Running on a Saito Golden Knight 180 four-stroke running on glow fuel, the 80-inch-span airplane handles well. A long-time Hitec Team pilot, Roger uses a Hitec Aurora 9 transmitter and a Hitec Optima 7 receiver for control. The weight of the Nieuport is approximately 18 pounds fully loaded with fuel. The plane has competed in many events in the past, including Top Gun, and has placed well, being awarded several plaques for its scale detail and its flying characteristics.

Blade/Horizon Hobby Theory Type W

This flying wing has a camera in its cockpit!

BY **LARRY COOPER** PHOTOS BY **JOHN REID**

First-person-view (FPV) racing is the hot new trend in RC flying, and the Blade Theory Type W is the plane to get you into the action and make you competitive right out of the box. The fuselage comes with the radio and motor installed, and the plug-in wing halves make the plane easy to transport and assemble.

AT A GLANCE

MODEL
Theory Type W FPV-Equipped BNF Basic

MANUFACTURER
Blade (bladehelis.com)

WINGSPAN
30 in.

PILOT SKILL LEVEL
Intermediate

ASSEMBLY TIME
30 minutes

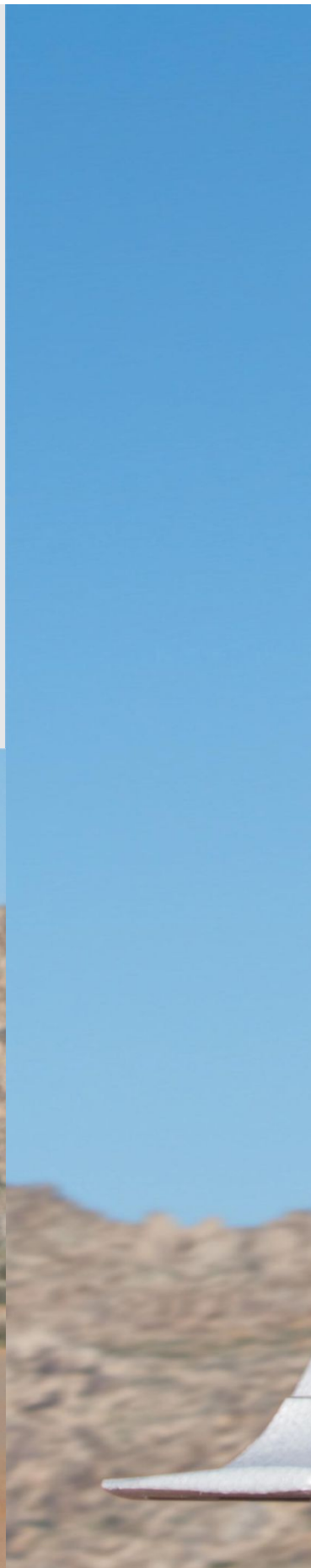
RADIO REQ'D
5-channel DSMX- or DSM2-compatible

POWER REQ'D
3S to 4S 1300mAh LiPo

PRICE
$299.99 (as reviewed); $219.99 (FPV-Ready)

WHAT WE LIKE

- Fast and fun
- Tears up the sky
- Tough as can be
- Space-age appearance



YOU NEED QUITE A BIT OF ROOM TO ALLOW FOR ITS 90MPH SPEED. IT HANDLES WELL, SO YOU CAN EASILY KEEP IT OVER THE FLYING FIELD. IT RESPONDS INSTANTLY TO THE INPUTS AND GOES EXACTLY WHERE YOU POINT IT.

When hand launching, a level toss is best if you can manage it.

GEAR USED

RADIO
Spektrum DX6i (spektrum rc.com); two 9g digital metal-gear servos (installed)

MOTOR
2205-2350Kv brushless motor w/ 30A speed control w/ 2A BEC (installed)

PROP
5x4 (included)

BATTERY
Thrust 4S 1300mAh 35C LiPo (e-fliterc.com)

The wings plug into the fuselage and snap into place.

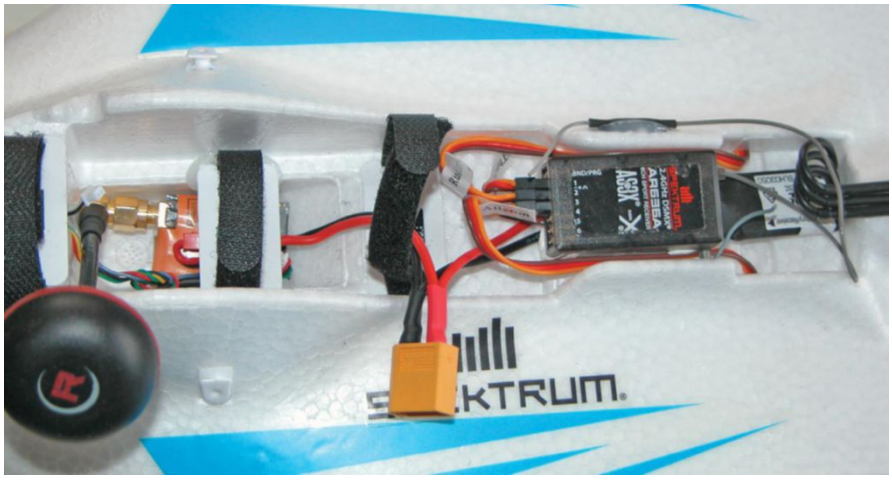
The motor comes installed at the back of the wing with the propeller attached.

The heavy-duty servos come installed from the factory with the linkages in place.

The Theory Type W FPV-Equipped BNF Basic model comes with an FPV camera installed and ready to link to your video receiver. You can also buy the FPV-Ready version and install your own FPV camera. The plane's Z-Foam construction makes it sturdy and crash resistant. The choice of flight modes makes this flying wing a terrific choice for intermediate pilots who want to get into racing. Its AS3X stabilization and SAFE Technology give it smooth flight characteristics and take the worry out of keeping it level in flight.

A great, easy-to-follow set of instructions is included. It is well written and includes plenty of great photographs, which make assembly and flight easy as pie. The Theory Type W uses DSMX/DSM2 Bind-and-Fly technology, so all you have to do is bind the plane to your transmitter.

The body and wing halves come plain, and you have a choice of four different color-scheme decals that you can mix and match to create a custom look. The plane also comes with two canopies of a slightly different shape to accommodate your style. The video antenna fits through the canopy and gives the Theory Type W a very cool, space-age appearance.



The radio compartment is roomy enough to easily install and remove the battery.

UNIQUE FEATURES

The Blade Theory Type W is loaded with features that make it one of the coolest planes at the field. This is a racing plane, and it's designed to be rugged. The Z-Foam material used in the wings and fuselage is tough stuff and resistant to impact. The canopy is sturdy black plastic and has a clever slot-and-tab mounting system, which keeps the canopy on at high speeds but

Spektrum Focal V2 Goggles

After the aircraft, one of the biggest investments you can make in FPV flight is a set of goggles that will allow you to see the world from your aircraft. Fat Shark, which has dominated the goggles marketplace, and Spektrum, which has dominated the RC market, have combined forces to make the Focal V2 goggles. This premium FPV headset offers high image quality due in part to its built-in antennae diversity, which optimizes the reception with both long-range and omni-directional antennae. The goggles are also comfortable and easy to wear all day long, and they even have a built-in fan to prevent fogging on hot race days! Add in Spektrum's technology for wireless head tracking and channel selection at a cost of $399.99 and you have a terrific deal for the FPV pilot. spektrumrc.com

The camera comes mounted to the front of the plane. You just link it to your video equipment.

still makes it easy to remove to swap batteries.

The wings literally plug into the fuselage with tabs that snap into place, securing the wings as if they were glued into place. Blade even has a patent pending on this new technology, which makes it super easy and quick to get the plane flight ready. The wing halves come with the digital metal-gear servos installed and the linkages connected. You just plug the servo wire into the mating end in the fuselage. The linkages on my plane were adjusted almost perfectly out of the box and required only minor trim adjustments on the first flight. Binding to the radio is a no-brainer with the supplied binding plug, and the instructions are super easy to follow.

One of the features I found most useful was the built-in grip on the bottom of the fuselage. It is large enough for meaty hands like mine and is a great help when hand launching this little screamer into the air.

The high output brushless motor is installed at the rear of the wing with a bright green propeller. This motor is compatible with both 3S and 4S battery packs and requires no installation. It delivers all the power you'll want.

Not visible but really cool are the programming modes available to manage your flights. The Launch mode keeps the plane stable when you toss it, and when it's airborne you can switch to Intermediate mode to tear up the sky, with the SAFE system still engaged to help with stability. Or you can switch to Experienced mode, which turns off SAFE but keeps the AS3X engaged.

The FPV is, of course, as cool as the rest of the plane. The flight camera comes with a customizable on-screen display and a 200mW 5.8GHz video transmitter. You can even program your name into the camera if you so desire. A really fabulous aspect of this feature is that you can record your flights and play back those thrilling moments when you passed your racing buddy.

IN THE AIR

Your local soccer field is a great place to fly the Theory Type W. You need quite a bit of room to allow for its 90mph speed. It handles well, so you can easily keep it over the flying field. When you plug in the battery, have the plane on a level surface and keep it there until you arm the motor. That orients all of the stability features to ensure the best possible flight characteristics. The receiver will beep a few times to let you know it is ready.

GENERAL FLIGHT PERFORMANCE

Stability: Let's say the Theory Type W is flying level and straight and you put it into a tight bank, like you're rounding a pylon. It responds instantly to the inputs and goes exactly where you point it. It comes back to straight and level and you are off to the races.

Tracking: The Theory Type W is not only fast but also responds nicely to the inputs and turns quickly and predictably.

Aerobatics: This wing is designed for racing, so it doesn't do the full range of aerobatics, but it makes up for it in raw speed. The Theory will easily do loops, so you can add some interest to your videos with a peek at the clouds.

Glide and stall performance: You don't have to fly it at full throttle; if you throttle back, it takes very little power to keep it in the air. The Theory Type W glides easily if you need a break from the speed or if you just want to train the camera onto an interesting target.

PILOT DEBRIEFING

This is a racing wing and has no landing gear, so hand launches are mandatory, but they're easy. Put the plane in Launch mode, take a couple of deep breaths, and use the built-in handle to toss it into the sky. As you let go, throttle up and watch it climb. It gets up to speed quickly and climbs aggressively. I find that keeping the toss straight and level gives you the best results.

Landing the Theory Type W takes a bit of setup because it glides so well and is so fast. Give yourself plenty of room for the approach, and throttle back to zero. It sinks nice and slowly at a shallow angle. That nice big grip on the bottom now acts as the skidplate, and the plane slides in on that and quickly comes to a stop.

BOTTOM LINE

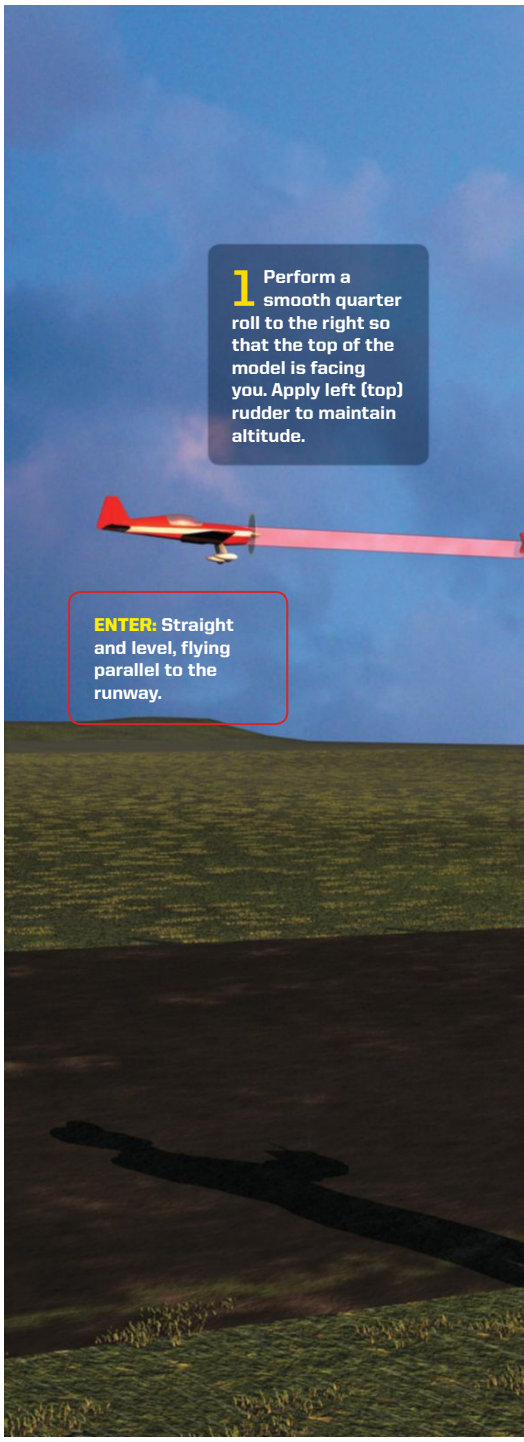
Getting the Theory Type W into the air is easy as can be. Put the battery on the charger and before it is charged, the plane is ready to fly. I had mine ready in about half an hour, including the decals. The plug-in wing halves make transportation simple and safe. The built-in stabilization and choice of flight modes make the Theory fun to fly. Get your FPV goggles and you will rock your flying world with your hot flight videos.

CUTTING-EDGE AEROBATICS

Mastering the knife-edge pass and variations

BY **JOHN GLEZELLIS**

For the aerobatic pilot, being able to perform a traditional knife-edge pass is beneficial for many reasons. To begin with, it is a fun maneuver to perform and serves as a prerequisite for other figures, like the popular four- and eight-point rolls. Moreover, it teaches that success in completing a figure with utmost consistency is hinged not only on ability but also on the aircraft's setup. In this article, we will examine how you can take advantage of your computer radio system to obtain predictable results from your aircraft. We will then explore the control inputs necessary to accurately perform this stunning stunt.



BEFORE WE BEGIN

As a starting point, always begin with the manufacturer's recommended control-surface deflection, exponential settings, and center of gravity. Common setup mistakes include not accurately measuring control-surface deflection on the control surfaces and either using too much deflection or not enough exponential. Using a ruler, start by checking the amount of maximum deflection for each surface. If a model has two elevator servos, one for each half, obtain equal travel on the left and right halves. Do the same for the ailerons, if applicable, and apply the proper amount of differential if it is listed in the manual.

Regarding rates, the radio should provide you with enough control-surface deflection to perform certain maneuvers. By using dual and/or triple rates, you can perform a stunt like the knife-edge and, with the flip of a switch, execute a spin or torque roll. If you try to fly the entire flight on a single rate, you'll often find that the airplane is too sensitive and that precise figures are difficult to fly.

Similarly, using the correct exponential percentage will soften how the aircraft will react around neutral stick, and as you move the control stick farther, maximum travel can be obtained. The point at which the rate changes will vary on the percentage of exponential that is used. A great starting point is typically 20% exponential on all control surfaces for the low-rate setting. You can then make adjustments, as required, to cater to your individual needs.

Next, it is time to test for the need to apply a given mix, or multiple mixes, to improve the characteristics of the model. For the next step, you'll need to perform a knife-edge, which is the maneuver of the month, and observe the natural result. Once the airplane is rolled 90 degrees to knife-edge flight and you command rudder input to maintain altitude, you might notice that the aircraft may push, in pitch, toward the landing gear or pull toward the canopy. In this case, a mix percentage will apply an appropriate amount of elevator input to keep a straight flight path that is parallel to the runway. This will decrease your pilot workload and promote consistent flight results.

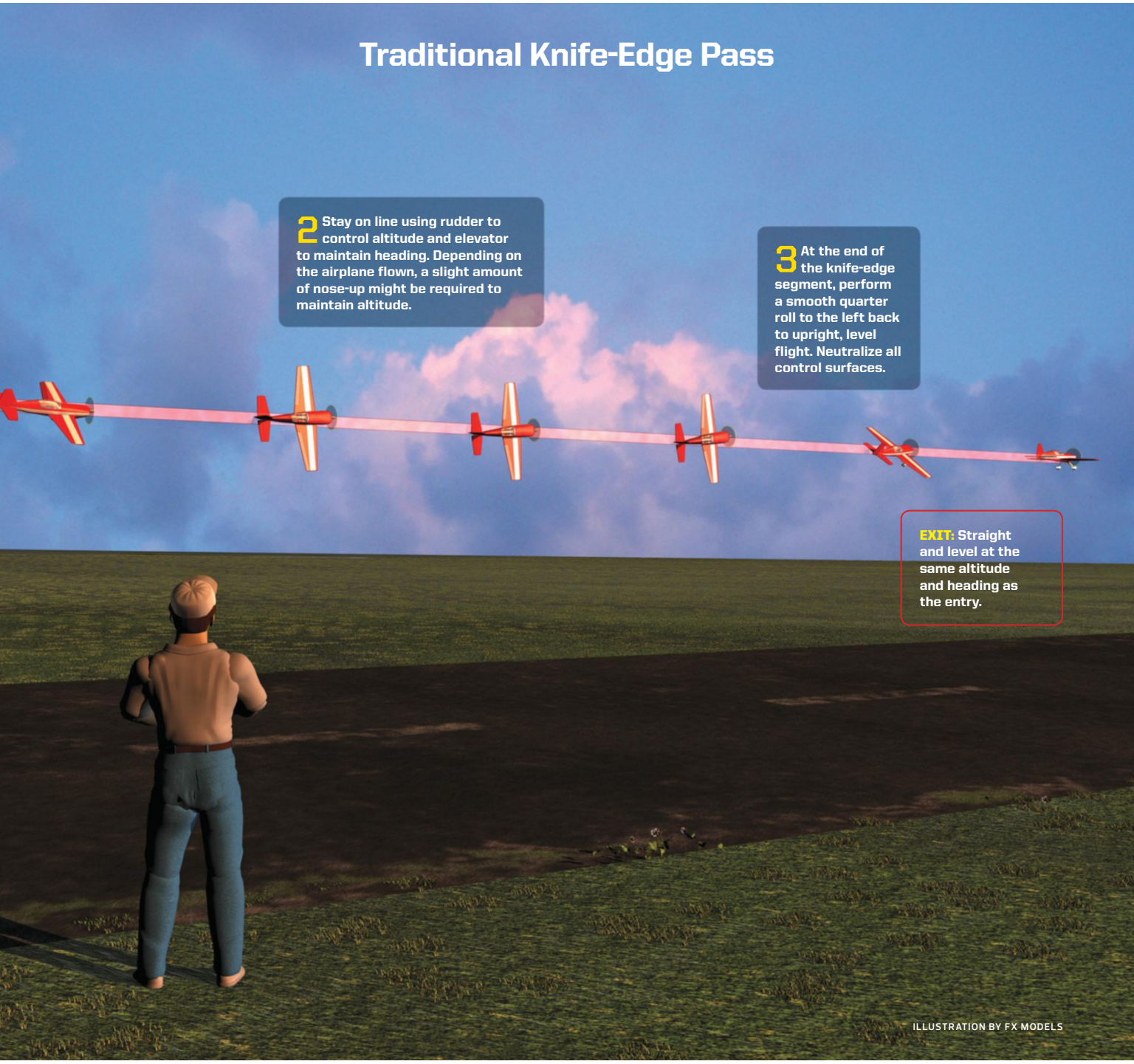
Mixing allows you to control a given input with an automatic effect of an output on another channel. In this example, the input is the rudder channel (also referred to as the "master" channel). When rudder is commanded by the pilot, elevator input (the "slave" channel) will be applied to the exact percentage that is defined throughout the mix. Similarly, if the model exhibits any roll during the knife-edge, a second mix (a "rudder-to-aileron" mix) can be used.

Most computer radios allow mixing percentages in 0.5% increments to allow for precise tuning of a model. If the mix percentage impacts other aerobatic figures, you can assign this mix to a switch if you do not wish to have the mix active throughout the entire duration of the flight.

Additionally, multipoint mixes can be used in a situation where a nonlinear response results during rudder deflection throughout the knife-edge pass. For example, if you fly a knife-edge by holding enough rudder deflection to sustain a particular altitude but then wish to transition into a climbing half knife-edge loop, you might find that the aircraft pitches in one direction or another when additional rudder input is applied. To correct this, create one mix percentage function when a specific amount of rudder is commanded, but when the rudder passes that deflection point, program the mix percentage to change. Explore the benefits of a multipoint curve mix compared to a standard mix and see which, if any, is required.

THE TRADITIONAL KNIFE-EDGE PASS

Align the airplane parallel to the runway and at a safe altitude of about 150 feet for a 60-inch aerobat. As the model approaches the runway, increase throttle and perform a 90-degree roll to knife-edge flight. At that point, you'll need



to apply rudder, as needed, to maintain altitude. To exit the maneuver, simply perform another 90-degree roll to upright level flight.

During the first few attempts, it is strongly advised that you perform the maneuver at a moderate altitude. Also pull the nose of the airplane about 10 degrees positive, relative to the horizon, to allow additional time to roll the airplane 90 degrees and apply rudder. During the first attempt, you might be quite surprised at how much—or little—rudder input is required to sustain a given altitude while the airplane is rolled on its side. Let's divide this figure into three basic steps:

Step 1: The example maneuver is flown from left to right. Begin by aligning the aircraft with the runway so that it is traveling into the wind. Increase throttle to 60%, and ensure that the proper flight mode is selected. At a distance of about 200 feet from the center point on the runway, perform a quarter roll to the right so that the top of the model is shown, and apply left rudder (also referred to as "top" rudder) to maintain altitude. During the roll, partial rudder input might be required. The result should be a smooth 90-degree roll with no heading or altitude loss.

Step 2: With this figure centered on the pilot, the distance flown when the maneuver began compared to when the airplane is directly in front of the pilot should be the same for the second half of the figure. Keeping that in mind, apply any corrective inputs that might be required to sustain altitude and the desired roll angle.

Step 3: Perform a quarter roll to the left to exit the maneuver in upright level flight, and prepare to give this maneuver another try until it is perfected.

THE KNIFE-EDGE SLIDE

The knife-edge slide (also referred to as the "death slide" or "knife-edge elevator") has become quite a popular stunt for the brave! After you've mastered the traditional knife-edge pass, you're ready to conquer this variation.

Align the upright aircraft parallel to the runway, into the wind, and at an altitude of about 600 feet for a 60-inch-span aerobat. Adjust the altitude, as needed, to cater to the size of the aircraft being flown. During the first few attempts, you can only benefit from a higher entry altitude in the event that you become disoriented. If this occurs, simply neutralize control inputs, note the orientation of the aircraft, and apply power combined with corrective inputs to recover the model.

As the aircraft approaches the runway, decrease throttle, switch to your 3D rate, and roll the model 90 degrees to knife-edge flight. Then, as the airspeed decreases, begin to apply more and more rudder with a proper balance between throttle and rudder. The ultimate goal is to have the aircraft perform a knife-edge descent with minimal forward movement. Once the aircraft is at an altitude of about 150 feet, simply apply more throttle, gradually decrease rudder, and roll the aircraft 90 degrees to exit the maneuver in upright level flight. Let's divide this figure into four basic steps:

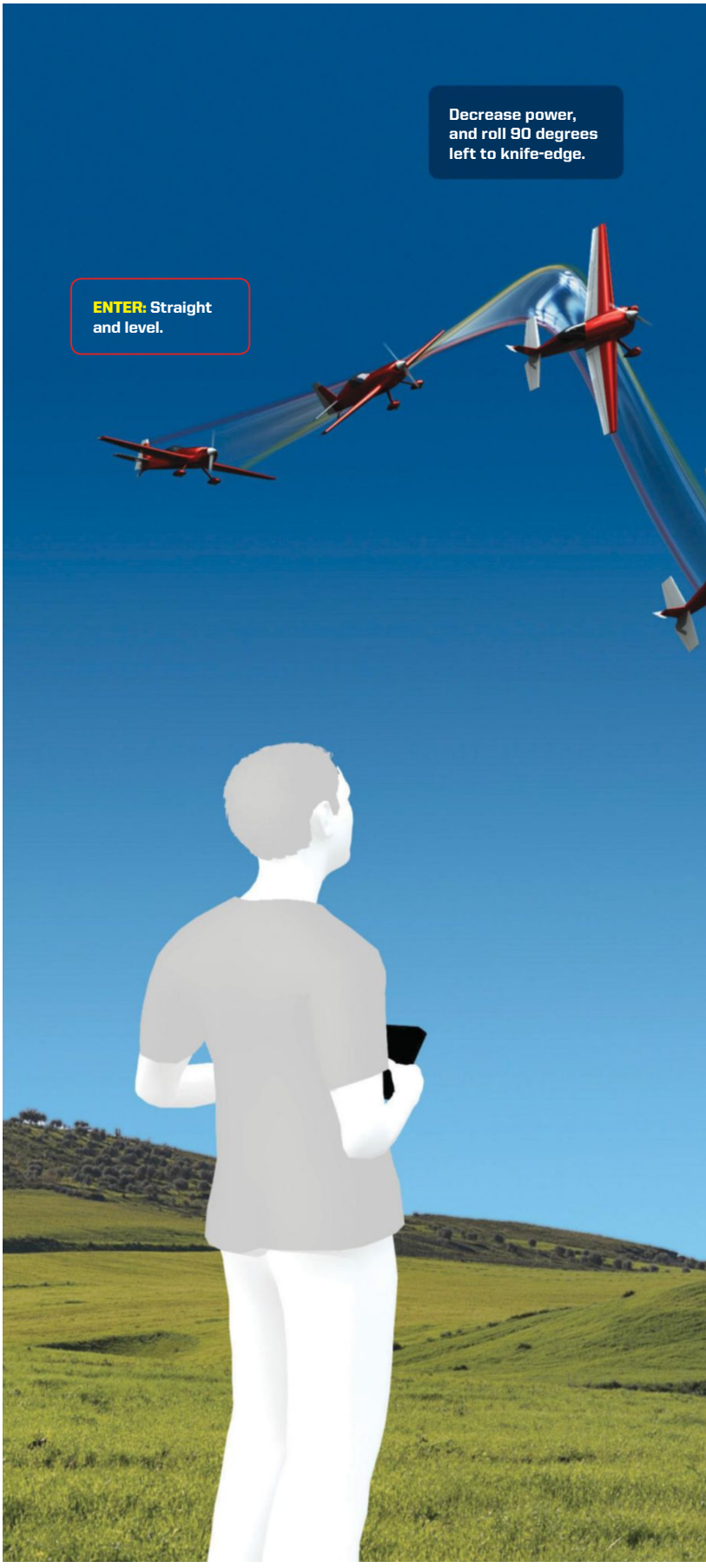
Step 1: Align the aircraft with the runway so that it is traveling into the wind at a fairly high altitude while in upright level flight. Activate the 3D rate and slowly decrease throttle. As the speed of the model decreases, roll the aircraft 90 degrees to knife-edge flight. In this example, we will perform a quarter roll to the right. As a result, left top rudder is required to maintain altitude.

Step 2: Gradually apply maximum rudder deflection and add throttle so it is at about 25%. Most aerobatic models will begin to descend at this throttle percentage with maximum rudder deflection applied, but all airframes are different and may require slightly different amounts. Corrective control inputs will become necessary as some airframes are more stable than others during this maneuver.

Step 3: It may become necessary to decrease throttle amount once the aircraft has stabilized in knife-edge flight. While the nose of the aircraft may not sit parallel to the runway, the aircraft will drop in altitude and execute the knife-edge slide. When the airplane is nearing an exit altitude of about 150 feet, begin to increase throttle to prepare for the knife-edge slip transition into standard knife-edge flight.

Step 4: Apply more throttle to execute a radius, all while in knife-edge flight, to transition from the slide portion of the figure to a knife-edge exit. When throttle is increased, decrease the amount of rudder needed so that the aircraft maintains altitude while in knife-edge. Perform a quarter roll to the left to exit the maneuver in upright level flight.

Most pilots may experience difficulty applying corrective inputs throughout the maneuver. Occasionally, an airplane may become somewhat unstable during the descent with respect to pitch. The proper aircraft setup will decrease the workload of the pilot. If you observe the plane pitching during the descent, use a "rudder-to-elevator" mix to automatically apply elevator with rudder. Remember, consistency is hinged on the aircraft setup as much as the skill of the pilot.



The Knife-Edge Slide

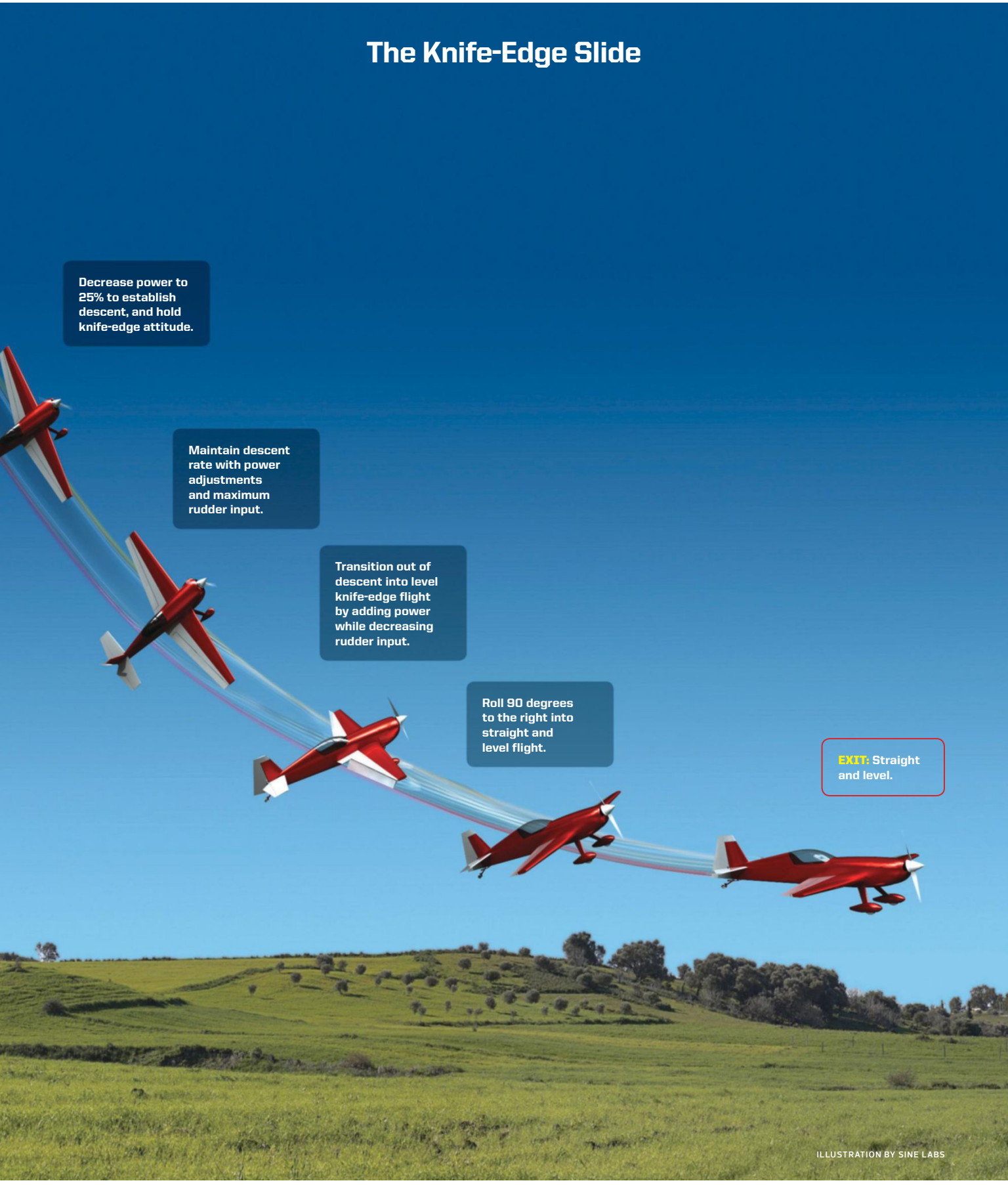


ILLUSTRATION BY SINE LABS

THE KNIFE-EDGE CIRCLE WITH 1 1/2 POSITIVE SNAPS

The first time I saw a knife-edge circle was at the Tournament of Champions in Las Vegas, Nevada. Seeing an airplane rolled 90 degrees to knife-edge flight and having the pilot push on the elevator stick to initiate the circle while maintaining altitude with rudder was a sight to behold—and it still is!

With time, pilots began adding their own twists to this maneuver for numerous variations. The knife-edge circle with 1 1/2 positive snap rolls is stunning to watch as it combines an inside and an outside circle, making it look elegant while adding some aggressiveness.

To begin, fly the model in upright level flight, parallel to the runway, traveling into the wind at a moderate speed. For this example, the maneuver will be flown from left to right. At about 50 feet altitude and just before the airplane reaches you, roll the aircraft 90 degrees into knife-edge flight and apply top rudder to maintain altitude. Roll to the right to see the top of the airplane and apply left top rudder. As soon as the airplane is directly in front of you, begin to lightly push elevator to initiate the circle. The radius in the first 90 degrees dictates the size of the circle. As soon as the airplane is about 45 percent complete with the circle, begin the 1 1/2 positive snap rolls so that the snap rotation will be centered on the circle at the midway point of the circle. The direction of the snap roll should be the same direction as the top rudder. With left top rudder, the snap roll should be to the left. Once the snap is completed, immediately switch to right top rudder and begin pulling on the elevator to complete the second half of this knife-edge circle. Apply elevator and rudder input as needed to keep the same circle size and to maintain altitude. Once the maneuver is complete and the airplane is about 50 feet past you, perform a 90-degree roll to the right and exit the maneuver in upright level flight. Let's divide this figure into four basic steps:

Step 1: Begin this maneuver by lining up the aircraft to the runway so that it is traveling into the wind at a fairly high altitude and at a moderate flight speed. Adjust the throttle setting as needed for your aircraft. Before the airplane approaches the center point, which is directly in front of the pilot, a 90-degree roll should be performed. Rolling to the right, left rudder will be applied to keep a constant altitude. Remember: Smoothness in control inputs is key!

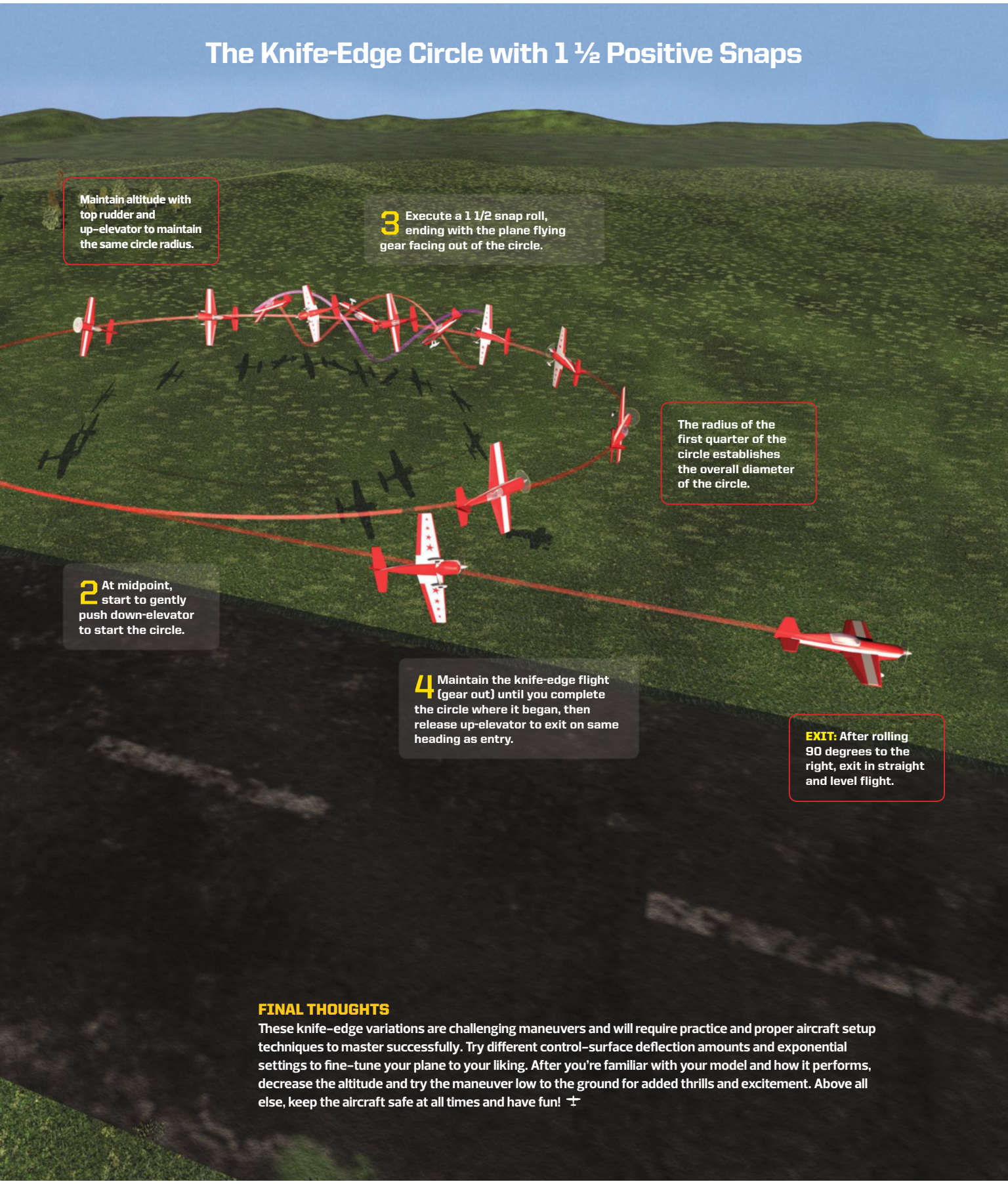
Step 2: Push ever so slightly on the elevator control surface to initiate the circle. A constant radius should exist as well as no change in altitude. Minor corrections in rudder, elevator, and aileron will be needed so that the aircraft is in the proper knife-edge attitude throughout the circle. As the aircraft approaches the midway point of the circle, the pilot must prepare for the snap-roll segment of the maneuver. The point at which the snap will be performed will differ depending on the speed of the aircraft and the amount of time it takes to execute the snap roll. The goal, though, is to have the "snapping" segment centered at the 50 percent completion point of the maneuver.

Step 3: Since left top rudder is being held for this example, the snap rotation must occur to the left so that the aircraft performs the snap rotation "away" from the ground. As soon as the 1 1/2 snap rotation is complete, however, the pilot must switch the direction of the rudder input as holding left rudder will drive the aircraft toward the ground! Holding right top rudder, immediately start applying up-elevator input to keep a constant radius, equal to the first half of the circle, for the next segment of this maneuver. No flat spot should exist at any point throughout the figure. Rather, it should be one continuous circle if one was to view the maneuver from the top.

Step 4: To complete this maneuver, apply the necessary rudder, elevator, and aileron corrections to keep the aircraft performing an inside knife-edge circle so that no deviation in altitude or the size of the circle exists. As the airplane passes the pilot, the pilot should perform a 90-degree roll to the right to exit the maneuver in upright level flight and release the right top rudder as the 90-degree roll is performed so that no change of heading will exist throughout the rolling segment. Next, prepare to give this maneuver another try!

ILLUSTRATION BY FX MODELS

The Knife-Edge Circle with 1 ½ Positive Snaps



FINAL THOUGHTS

These knife–edge variations are challenging maneuvers and will require practice and proper aircraft setup techniques to master successfully. Try different control–surface deflection amounts and exponential settings to fine–tune your plane to your liking. After you're familiar with your model and how it performs, decrease the altitude and try the maneuver low to the ground for added thrills and excitement. Above all else, keep the aircraft safe at all times and have fun!

Aerobeez 32-Inch Edge 540 EPP Foamie

For little investment, this 3D aerobat delivers maximum enjoyment!

BY **MIKE GANTT** PHOTOS BY **JOHN REID & MIKE GANTT**

Walking into the local hobby shop can be a game changer for some, and I'll never forget the day I saw a young and talented pilot/employee hovering his model airplane inside. He caught the plane from the air and recommended that I try an EPP (expanded polypropylene) foam plane for my first 3D kit. Skip ahead a decade or so and Aerobeez has introduced a perfect 3D practice plane.

AT A GLANCE

MODEL
32-Inch Edge 540 EPP

MANUFACTURER
Aerobeez (aerobeez.com)

WINGSPAN
32 in.

PILOT SKILL LEVEL
Intermediate

ASSEMBLY TIME
4 to 12 hours depending on glue used

RADIO REQ'D
4+-channel

POWER REQ'D
2203- or 2204-size brushless outrunner

PRICE
$40.00

WHAT WE LIKE

- Simple build/assembly
- Lightweight; low wing loading
- Cool preprinted color scheme
- Super fun to fly

The Edge is easy to hand-launch at any angle and will climb vertically all day.

When built true and straight, this plane should only require rudder input for knife-edge flight.

FREESTYLE AEROBATICS ARE THE EDGE 540'S FORTE. ANY MOVE YOU CAN DREAM UP IS PRETTY MUCH DOABLE.

GEAR USED

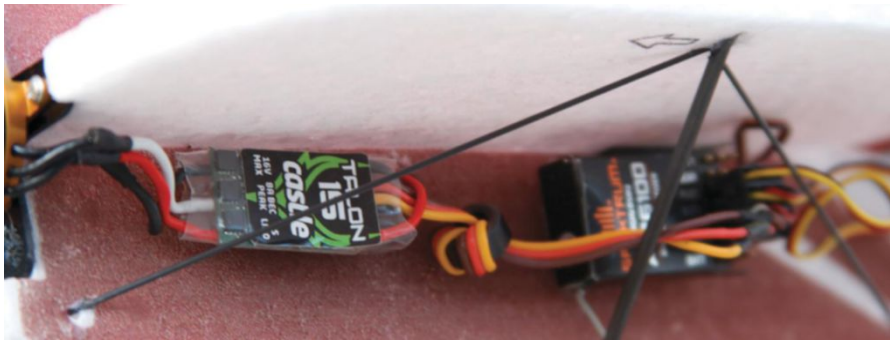
RADIO
Spektrum DX18G2 w/ AR6100 receiver (spektrumrc.com); Hitec HS-35HD servos (hitecrcd.com)

MOTOR
AXi 2203/46 (icare-rc.com); Castle Creations Talon 15 (castlecreations.com)

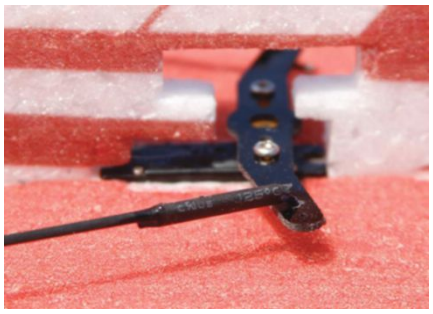
PROP
GWS EP8040 (gwsprops.com)

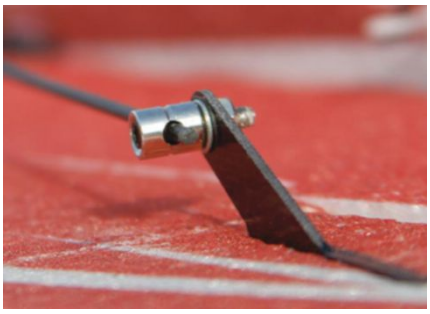
BATTERY
FlightPower 2S 350mAh LiPo (flightpowerbatteries.com)

This slick-looking profile platform is done in the Edge 540 outline and easily fits in any car (you never know when your 3D itch will need a scratch!). Opening the superslim box unveiled six cleanly cut and preprinted airframe parts, plenty of carbon-fiber (CF) rods and support pieces along with a pair of plastic wheels wrapped with foam tires. Laser-cut control horns, side force generators, hook-and-loop tape, and a few fasteners arrive in a sealed bag. Even a bottle of adhesive was included and is of the good-contact-cement variety. While complete as a foamie kit, you will need a power system and guidance system along with a few batteries as one or two might not be enough for all the flying you'll want to do! Aerobeez has a build log for the Edge on its website, where color photos and step-by-step instructions help you build a fun-flying and forgiving airplane.



Above: The Talon 15 has a better BEC and is actually smaller than my old Phoenix 10! Light components yield the best results; the AR6100 weighs 3.5g. Below left: An offset aileron servo arm is provided in the kit and simply screws on. Below right: The included quick links facilitate control-surface setups and adjustments.





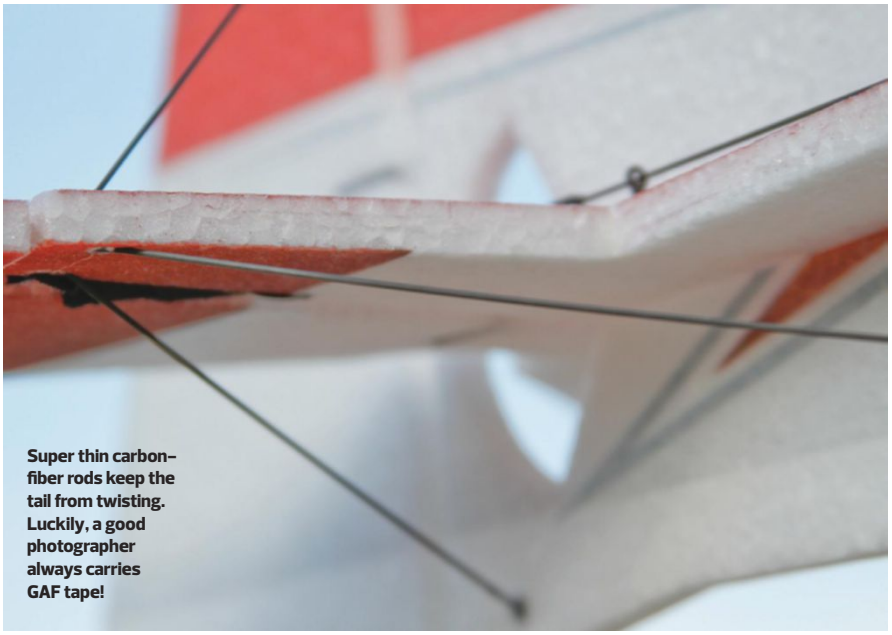
UNIQUE FEATURES

After inspecting the kit, you will need to tame the hinge lines: Simply fold/double them over and place some kind of weight (like a book) on top of the part and let it sit overnight on a flat surface. Red, black, and silver are well printed on the EPP parts in a cool color scheme. A quick mock-up of the airframe shows off the sharp lines and made me want to get gluing! A feature that I really appreciated was that Aerobeez added small "keys" in certain areas that prevent the fuselage, elevator, and wings from being installed incorrectly. Small manipulations of the wing root's sizes and mating fuselage areas only allow you to install them the correct way. The same goes for the tail section: a simple notch on one side of both parts can only go together one way and will save you from a headache. A hollow, square CF tube fits into a precut slot in the wing and, when glued in, transforms the foam into a stronger structure. The included bracing system is more than adequate and, when installed, makes the airframe quite solid. More CF rod is used to keep the tail from twisting, and the slightly thicker pieces are used as landing-gear legs. As mentioned, there are real wheels and even wheel pants; while these are optional, they are included. The motor mount is predrilled, but it is easy to redrill to fit your motor if needed. A bit of glue holds said mount to the nose, and small pieces of hook-and-loop tape will hold your speed control and receiver in place. The servos are glued to the airframe; so if you don't want glue on your actuators, add some painter's tape to their cases prior to adding any adhesive. CF control rods are set up with metal Z-bend ends and allow for a clean control-linkage setup. The longer rods used for the tail controls are supported along their lengths with guides, which are lightweight and simple to install. Be sure to line them up, and make sure the rods move freely before finalizing the support-pieces

positions. When it comes to electronics, you'll want to use your lightest components because lighter flies better. Servos in the 7g (or less) weight class, a small speed control, and a sub-1-oz. motor will deliver fun, floaty flights. These small motors typically have built-in prop adapters or "prop savers."

IN THE AIR

A small piece of wire or CF added under the tail will help with runway takeoffs, which are short. The Edge basically leaps up into the air with ease. You could also hand-launch the model: Hold it with the propeller away from yourself (or anyone else!), power up to around half throttle, and let it go. The power available is almost silly, and full throttle is not needed unless you want the plane to climb vertically in a hurry. Conventional landings can be performed with little effort, but better-looking harrier and elevator landings are easy, too. The Edge can also fly indoors with its incredible agility.



Super thin carbon-fiber rods keep the tail from twisting. Luckily, a good photographer always carries GAF tape!

GENERAL FLIGHT PERFORMANCE

Stability: Aerobatic airplanes are designed to be unstable, but that's not the case here. Don't expect any return to level or self-righting, but you will admire how easy this Edge 540 is to pilot. Also, this model weighs less than half a pound, so the wind will have some effect on it.

Tracking: Airframe rigidity pays off here, so there is no tail twisting, and it was nice to see that this small and lightweight EPP model airplane stays on course well with minimal control input. Tracking through point rolls and square loops demonstrated no course vicissitudes, so these servos and linkages do their jobs well.

Aerobatics: Here is where the plane shines. Freestyle aerobatics are the Edge 540's forte! The AXi motor and 8-inch propeller I used provide plenty of thrust for 3D fun. Rolls are faster than I was prepared for and are fairly linear. Loops can be tight—almost fuselage size—and any move you can dream up is pretty much doable.

Glide and stall performance: Minimal inertia is carried in flight, so high energy moves and glides are short-lived. The plane was designed to fly well poststall—and it does. Powering off and adding full up-elevator doesn't really do anything scary; it only leads to another cool-looking maneuver.

PILOT DEBRIEFING

If you want to learn to hover, perform torque rolls, and do all the other gravity-defying sky tricks, you should get one of these 32-Inch Edge 540 EPP planes. Repairs are easy if you happen to bang it up and much less expensive than with any built-up airplane. This builds confidence and lets newer pilots practice down low with less stress. Flight times will vary with battery size.

Easy Repair Tips

Expanded polypropylene, or EPP, foam could also be called "extra plane protection." It is flexible and tends to bend rather than break in the event of a hard hit or landing. Because it's compatible with regular CA, EPP can be repaired easily at the field. For simple joint repairs, it is best to apply as little glue as needed to one side of the part and mist the mating part with activator. Carefully join the pieces, keeping your fingers off of the joint. (Your model airplane will be difficult to fly with a life-size pilot attached!) Note that there may be slight yellowing at the repair joint as CA can change color as it cures. Alternatively, you could use contact adhesives such as Foam-Cure or Foam-Tac for your fixes. These types of glues take a little longer to cure, but there is no yellowing and joints tend to remain more flexible—a good thing. For faster fixes when using contact cement, add a very thin layer to both parts to be joined and touch the parts together for a few seconds. Separate and wait for the glue to tack up. After the parts feel dry, you'll want to join them together as precisely as possible because once they stick, they're stuck. No hurry? Simply add the glue as mentioned before and join the parts. You will have more time to position things correctly because it takes longer for the glue to set up this way. I like to leave the joint undisturbed overnight.

BOTTOM LINE

The 32-Inch Edge is easy to put together, flies well, and is lots of fun. Its size allows it to go with you anywhere, and low-cost batteries will keep you flying for hours. You don't have to spend a lot of time building or repairing it, either. If you have a hard landing at the field, a little CA glue can get you back in the air fairly quickly.

Get Schooled!

This 73-page bookazine is a collection of articles from *RotorDrone magazine* that will give you a better understanding of drones, from the basics of the aircraft to gear and gadgets, mastering flight, and troubleshooting tips. Download it today at **AirAgeStore.com!**

From the editors of Model Airplane News

HOW TO

Back to Basics

ENGINE & RADIO INSTALLATION

BY **GERRY YARRISH** PHOTOS BY **PETER HALL & GERRY YARRISH**

In the last issue, we set the stage for building the Phoenix Model Sonic Mk II low-wing sport flier. We went from parts in the box to a completely assembled airframe. With this article, we'll highlight the installation of the power system consisting of the O.S. Max .25 two-stroke glow engine, its motor mount, the fuel tank, and the fuel lines. We'll also install the receiver and the rest of the servos in the airplane to control the rudder and elevator, and attach all the control linkages. Let's get started.

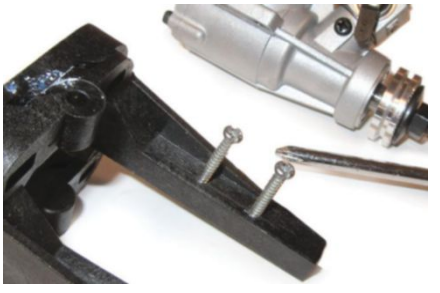
ENGINE INSTALLATION

The Sonic ARF comes with a composite engine mount, and it is molded in two pieces so that its width can be adjusted to accommodate a variety of engines. The two backplates overlap and can slide back and forth, changing the distance between the two rails. Slip the two halves together and then place the engine in the middle of the rails so that it fits between the two side webs.

Once you have the engine-mount parts "sized," remove the engine and place the back of it on a flat surface; press the parts together so that the back is flat with the two pieces flush to each other. Now add a couple of drops of thin Zap CA glue, and spritz with a little Zip Kicker to hold the parts together.

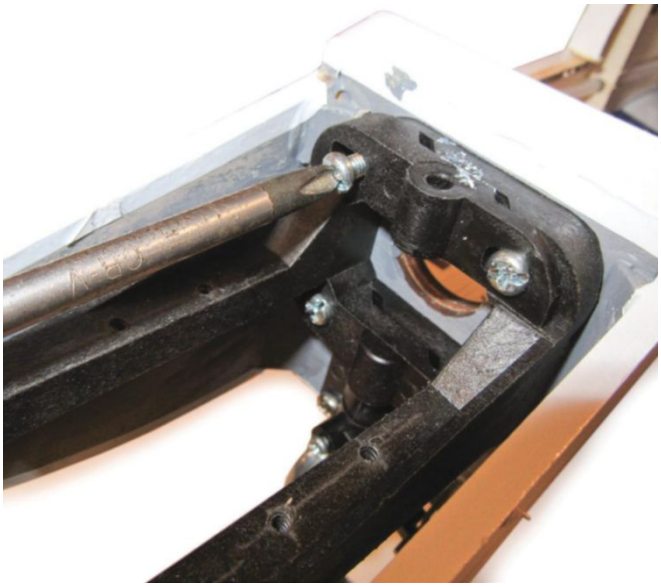
TECH TIP

Although the included hardware is more than strong enough for the job, you may find it easier to replace the engine attachment screws with 2mm cap-head screws so that you can use an ball driver Allen wrench to thread them into place. Often with constant use, the slots in Phillips-head screws will begin to wear out.

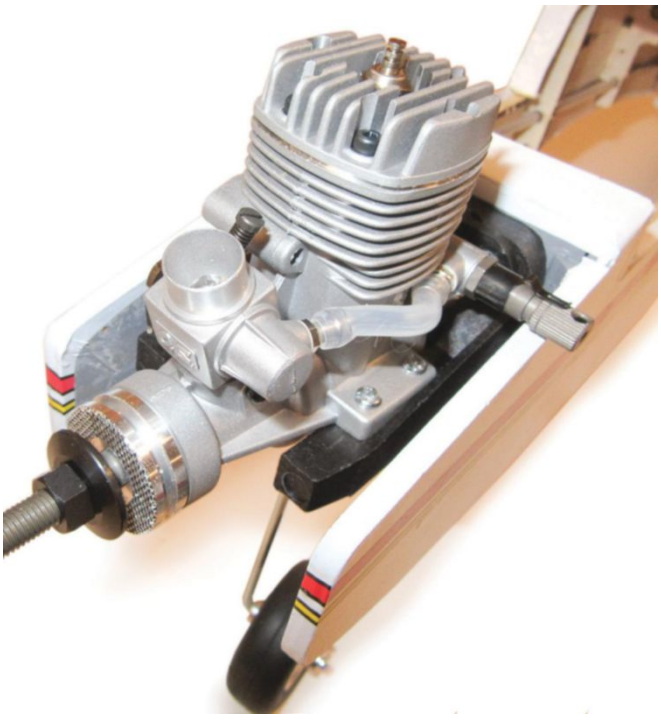


To attach the engine to the engine mount, you first have to drill holes into the rails and use the included screws to secure it into place. Position the engine on the engine mount so that the engine's attachment tabs are in the middle of the rails, then use a sharp pencil to transfer the hole locations onto the tops of the rails. Using a 3/32-inch drill bit, carefully drill the four holes. Make sure you drill the holes so that they are straight vertically and square to the rail tops. Use the four 2mm x 3/4-inch-long self-tapping screws; insert one at a time, and screw them into place about a quarter inch deep.

There are four long 4mm screws that hold the engine mount in place. Insert the screws into the mount and thread them into the blind nuts installed in the firewall. If there are any burrs, it may be difficult to thread the screw into place. Replace the blind nut with a new one. As you thread the screws into place, add a small drop of Zap thread locker on the end of the screws, and use a crisscross pattern to tighten the screws snugly into place.



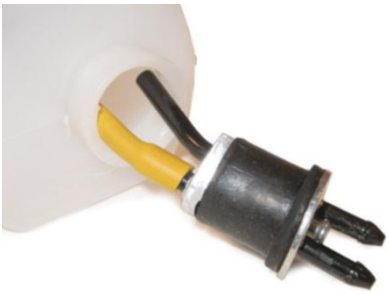
With the engine mount secure, attach the Z-bend end of the throttle pushrod to the engine's throttle arm, and place the engine on the mount while slipping the pushrod into the guide tube. Reinstall the engine on its mount, and tighten the attachment screws snugly into place. (Note: To prevent damaging the fuel line connecting the carburetor to the needle-valve assembly, remove it before screwing the engine in place.)



FUEL TANK

The Sonic comes with a fuel tank and its stopper and outlet tubes, but you have to supply the fuel line. Any glow fuel tubing will work, but I have found that the new ProFlex Universal Fuel Line works extremely well. It doesn't harden over time and is extremely flexible, which helps prevent it from slipping off of the fuel fittings.

To install the fuel tank in the fuselage, loop two heavy-duty cable tie-wraps under the fuel-tank tray through the side notches so that the ends extend out of the fuel-tank compartment. Slip the tank into the fuselage, and push it back so that the front can clear the front of the hatch opening. Insert the two fuel lines through the opening in the firewall, and pull them out as you slide the fuel tank forward. The neck and stopper of the tank fits into the firewall opening. Add a second tie-wrap to each of the other two, and tighten them so that they hold the tank firmly into place. Snip the ends off of the tie-wraps, then trim away some material from the bottom of the hatch cover so that it clears the tie-wraps. The hatch cover is held in place with a spring-loaded latch.

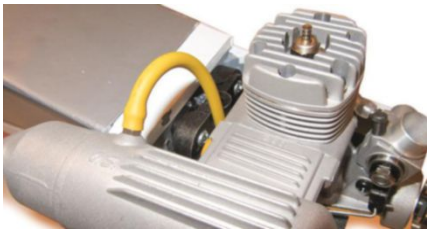


Check the opening of the tank to see if there is any sharp flashing present. This could cut into and damage the rubber stopper. If there is, use a sharp hobby knife to cut it away, producing a slight bevel on the inner edge. Cut a piece of the ProFlex fuel line to length so that, when you slip it onto the outlet tube, it is about half an inch shy of reaching the back of the fuel tank. Slip the metal fuel pickup "clunk" into the end of the pickup line and then slip the stopper into place to check the pickup line's length. With the stopper pushed all the way in, the clunk should be about 1/4 inch shy of hitting the back of the tank. If it touches the bottom, remove the assembly and shorten the pickup line.

The top of the tank is closest to the stopper and tank neck. Insert the fuel line and stopper unit into the tank, and position it so that the vent tube is at the top of the tank, then tighten the screw until the stopper is tightly secure in the neck of the tank. You shouldn't be able to twist or turn the stopper. Before installing the tank in the fuselage, cut two lengths of fuel line about 6 to 8 inches long and slip them onto the fuel outlet's tubes. Add some tape to the vent line, and identify it with a "V" to help prevent attaching the fuel line incorrectly to the engine.

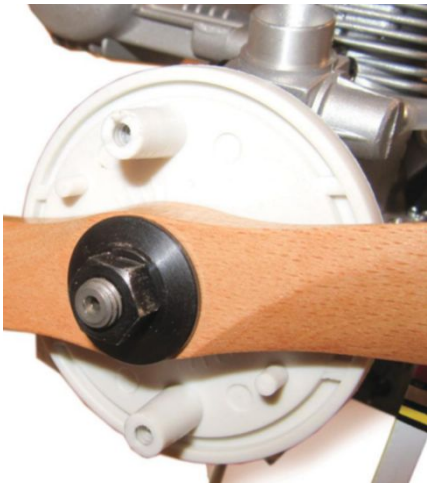
The ProFlex fuel line comes with thin pieces of wire that you wrap around and twist into place around the neck of the clunk. Using long-nose pliers, twist the wire tightly into place so that it clamps around the line, then snip off the end so that about 1/8 inch remains. Since the outlet and bent vent tubes are made out of plastic, do not use the clamping wire at those line attachments. Do not attach any fuel tubing to the inside of the vent tube.

Allow about 2 inches of excess length and cut the fuel-supply line to length, and slip it onto the fuel fitting on the back of the engine. Install the muffler on the engine, securing it with two black machine screws and lock washers, and connect the vent line to the muffler's pressure fitting, also allowing a couple of inches extra length.



There are two molded-in prop guides in the channel around the backplate, which the lip of the spinner front fits into. The propeller should be positioned in between these guides so that the blades fit in the spinner cutouts. Position the front of the spinner in place and then screw it to the backplate with the two 2mm x 1/2-inch screws.

To complete the power-system installation, all you have to do is install the included spinner and a Top Flite 9x5 Power Point propeller. The hole in the spinner backplate should be enlarged slightly so that it slips over the engine's prop shaft with little to no play. Place the backplate against the engine's thrust washer and the slip the propeller in place, followed by the prop washer and prop nut. Tighten the prop nut down snugly, then give it another quarter turn to really tighten it into place.



Electric Power

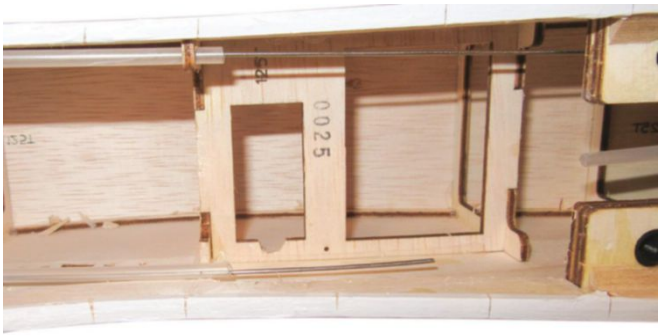
As the Sonic is designed to use either a glow engine or an electric power system, here are a couple of photos to show the e-power setup. The model also comes as part of the hardware package, with all the necessary parts to install an electric motor. These include all the aluminum standoffs and screws needed to attach the electric motor. For the Sonic, an ElectriFly RimFire .25 is recommended along with an ElectriFly 30A to 40A speed control. The wiring is easy as it is a plug-and-play and the speed controller is attached to the standoffs behind the model, out in the breeze for abundant cooling. Since the fuel tank is not needed, the tank tray is where the 3S 2000-3000mAh LiPo flight pack is installed. To select the proper e-power propeller, check the instructions that come with the motor.

RADIO GEAR

Nearing the end of this build, the next thing to tackle is the installation of the control linkages for the elevator, rudder, and throttle, along with their servos and the rest of the radio gear. Again, as we mentioned in the last issue, all the grommets and brass inserts have to be installed correctly in the servo-mounting tabs. Plug the servos into the receiver, and power up the transmitter and receiver to center the servo output shafts. You should also jot down which servos connect to which receiver ports. With the Tactic TTX650, the aileron lead mates with port 1, the elevator plugs into port 2, the throttle goes into port 3, and port 4 is for the rudder. Once this is done, we will install the servo arms after we work out the control linkages and attachment points.

SERVO INSTALLATION

Before installing the servos it is a good time to install the rudder and elevator control horns and the wire pushrods. You will have to cut away the covering from the guide tube exits so you can slide the pushrods into place. Screw the clevises to the threaded ends of the wire pushrods and you are ready to go. Inside the radio compartment there is a servo tray glued into place. Using the instruction booklet as a guide, position the servos as shown. I find that adding one servo at a time and then adding its control linkage is the easiest way to work in the confines of the narrow radio compartment. You remove the wing and then work through the open wing saddle.



I started with the sideways-mounted throttle servo as it is a tight fit and the tray needs a little trimming to clear the servo leads. Using a sharp hobby knife, notch the servo opening as shown; this allows the wires to be routed under the tray without pinching. While holding the servo in place, use a 1/16-inch drill bit and drill through the servo grommets into the tray; screw the servo into place.

Next, install the rudder servo. You need to use the dual servo arm as the servo will control both the rudder and the nosewheel steering. Position the rudder servo so that the holes in the servo arm align with the wire pushrod and the steering linkage for the nosewheel. While holding the servo in place, drill the holes and screw it into place. For both the throttle and the nosewheel steering linkage, threaded linkage connectors have to be used. These have threaded studs and locknuts used to attach them to the servo arms. You will have to enlarge the holes in the arms using a 1/16-inch drill bit. Insert the stud in the arm, and with one locknut above and below the arm, use two long-nose pliers to tighten the connector into place. There are holes in the sides of the connectors that accept the control linkages, and on the top is a setscrew to secure the linkage into place. Center the servo, then adjust the nosewheel so that it is centered pointing straight ahead; tighten the setscrew. Center the rudder, and mark the pushrod for the servo-arm hole location. Bend the pushrod 90 degrees at this mark, then attach it to the servo arm with a pushrod keeper. (See the "Build It Right" article in the June issue for details.)

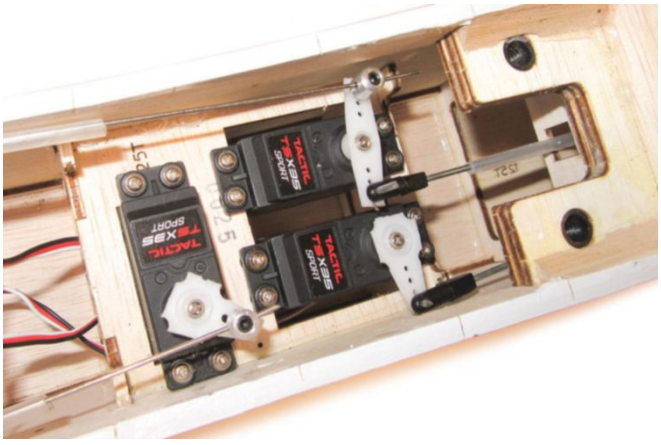
TECH TIP

With ARF models like the Sonic, the servo trays are often made out of softer wood, such as laminated balsa or light plywood. After you drill the servo-mounting screw holes, add a drop of thin Zap CA to each hole. This will soak into the wood and harden it where the holes are drilled, giving the screws a stronger "bite," which helps prevent the screws from stripping out the holes.

THROTTLE LINKAGE

The throttle servo is different from the rest of the servos as it does not rest in the centered position. To install the throttle linkage properly, you first have to use the transmitter and bring both the throttle stick and the throttle trim down to the idle positions. Typically, the throttle arm on the carburetor has a relatively short travel, so you should use a short servo arm, or you can use the second-to-last inner hole in the arm as the attachment point and cut the servo arm so that it clears the side of the fuselage.

Install the linkage connector and then insert the throttle pushrod. Pull the linkage back so that the carburetor closes fully, and tighten the setscrew at the top of the connector. Move the throttle stick all the way forward and check the movement of the carburetor's throttle opening. It should be fully open with the stick all the way forward; if it isn't or if the pushrod moves too far and bows slightly at the full-power position, you can adjust the servo travel later so that there is no binding in the linkage.

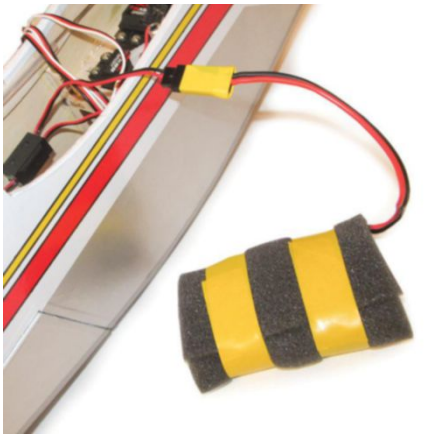


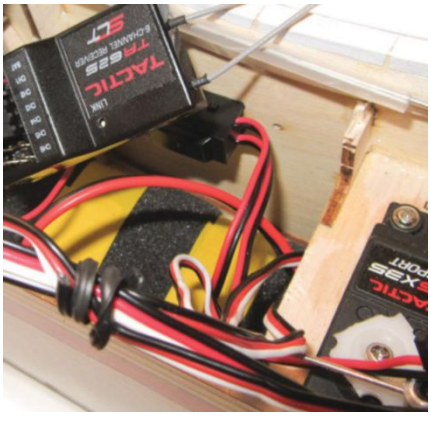
The elevator servo and linkage is the next one to do, and it is done in the same way as the rudder servo. Position the servo, using the arm as a guide so that it does not touch the fuselage side, and drill the holes and screw it into place. Center the elevator position, align the pushrod with the servo-arm attachment hole, and mark the pushrod wire. Bend 90 degrees at the mark, and attach the pushrod to the arm using the keeper to secure the linkage. At this point, you can turn on the radio system and check the movement of the servos and the control surfaces and linkages. There should be no binding throughout the servo arms' movement.

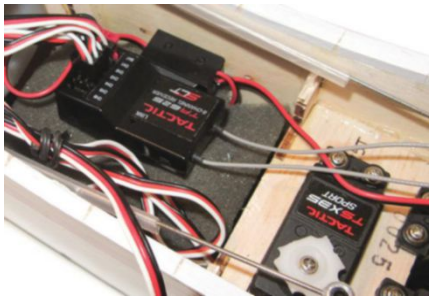
RECEIVER AND BATTERY PACK

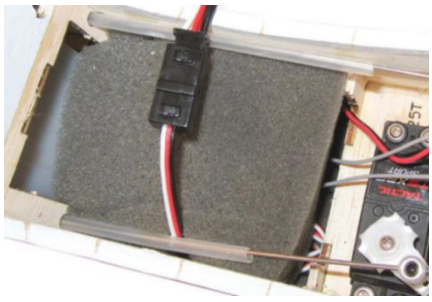
There is a square opening in the side of the fuselage, and this is where the radio power switch is installed. There are also two holes at the sides of the opening, and you can pop them open with a small screwdriver. Remove the switch cover, and position it with the "off" position facing the rear of the airplane. Insert the switch harness from inside, and screw the switch and switch cover together.

For a bit of safety during flight, use a piece of electrical tape and secure the battery pack's lead to the switch harness female connector. This will prevent vibration from causing the wires to come apart. Wrap the battery pack with 1/8-inch-thick packing foam, and secure it in place with two lengths of tape. Place the pack in the bottom of the radio compartment in front of the servo tray. Check all the servo leads as well as the switch-harness connector, making sure they are properly and completely plugged into their receiver ports.



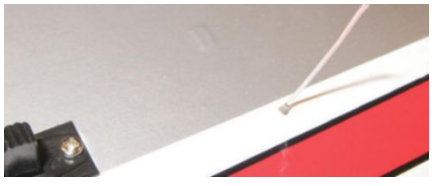






Place a 1-inch-thick piece of packing foam over the battery pack. This piece should be oversize by about half an inch so that it stays in place when inserted into the radio compartment. Position the receiver in the center of the foam. Using one of the wire wraps that comes with the new servos, gather and bind the servo leads together. This keeps the radio installation neat and helps prevent any of the servo leads from getting chafed by the servo linkages. Place another piece of 1-inch foam over the receiver, making sure that the dual antennae, the charging plug, and the aileron Y-harness are all accessible.

There are two antenna leads with the Tactic receiver, and they have to be installed so that the two outer ends are placed 90 degrees to each other. The easiest way to do this is to drill small holes in the sides of the fuselage and guide them through to the outside. Pull one all the way out, and tape it to the outside of the fuselage so that it points to the tail. Be sure not to have any tension on the antenna where it is connected to the receiver. For the other antenna lead, insert it in the hole on the other side of the fuselage so that only the very end of the antenna is exposed and it points 90 degrees from the fuselage side.



Use a few dabs of Zap Canopy Glue to secure the antenna leads where they go through the holes, and let dry. This glue remains flexible when cured and holds the antenna leads in place, but it is easy to remove later on.

FINAL ASSEMBLY

All that's left to do is to connect the aileron leads coming out of the wing to the Y-harness and then attach the wing to the fuselage. Make sure you push the wire leads back into the holes in the top of the wing, and be sure not to pinch the wire leads between the wing and the wing-saddle sides. When everything is aligned, tighten the two wing attachment bolts. You are now done building your Sonic ARF sport plane.

BOTTOM LINE

So that's it, our Sonic is ready to go. All that's left to get it ready to fly is to break in the engine, and make the final radio and servo adjustments with the Tactic radio's programming. But that's another story. If you have any questions we'd love to hear from you. Email us at MAN@airage.com.

TEXT & PHOTOS BY **JOHN KAUK**

PROGRAMMING SPEED CONTROLS

Modern electronic speed controls have been programmable for quite some time. Most of them are programmed by using the transmitter's sticks to move through a menu of choices and selections defined by flashing LEDs or beeps. I've never been very good at doing that, and most of the time, I just don't bother and use the manufacturer's default settings. Castle Creations speed controls can be programmed that way if you prefer, but they can also be programmed in a Windows PC application called Castle Link, via a small USB adapter available free with the purchase of the speed control.

Castle Creations' Phoenix Edge HV 120 is the speed control chosen for the author's A-10 project. It's a robust controller that is easily programmed, and the data logging is handy for checking the condition of the power system.

CONNECTIONS

The Castle Link USB adapter uses the three-wire servo connector to communicate with the ESC. If the controller is one with a battery eliminator circuit (BEC), the computer's USB port will power it without external power. The large, high-voltage speed controls don't have the BEC, so a battery is required to power them. After starting the Castle Link application and connecting the speed control to the USB adapter, the two connection-status indicators in the lower left corner of the application window will turn green to indicate all is well. With that, the programming can begin.

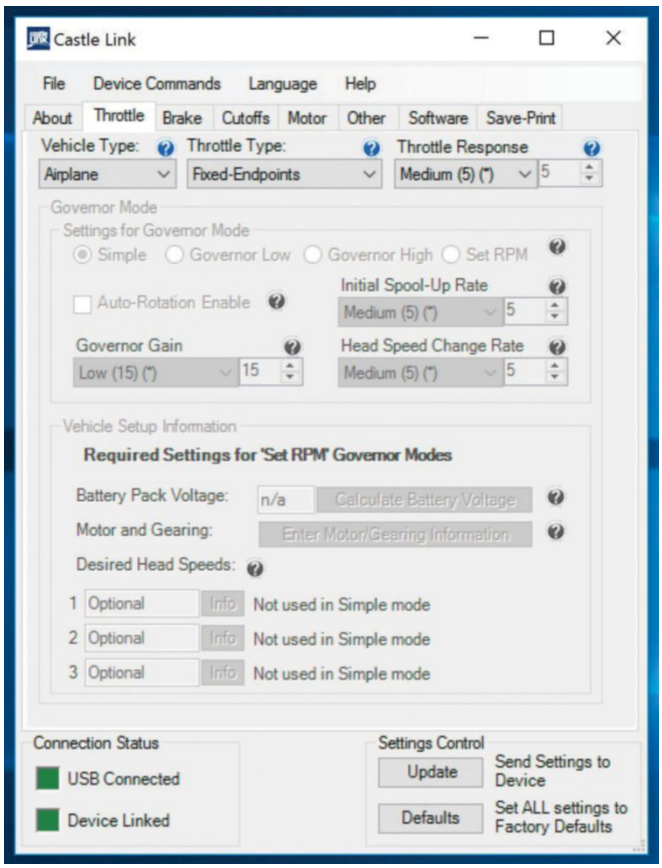
With a new controller, I always work my way through the settings tabs from left to right, making necessary changes in each screen and writing them to the speed control by clicking the Update button before moving on to the next screen. The default settings are usually fine for most planes, but there are a few changes I make as a matter of routine.

Jesse Cofer flies his KMP OV-10 at eWeek 2016. The 96-inch plane is powered by two E-flite Power 160s on 12S LiPos and 19x8 propellers. It's always fun to watch Jesse; he flies a lot, always in a very scale-looking way.

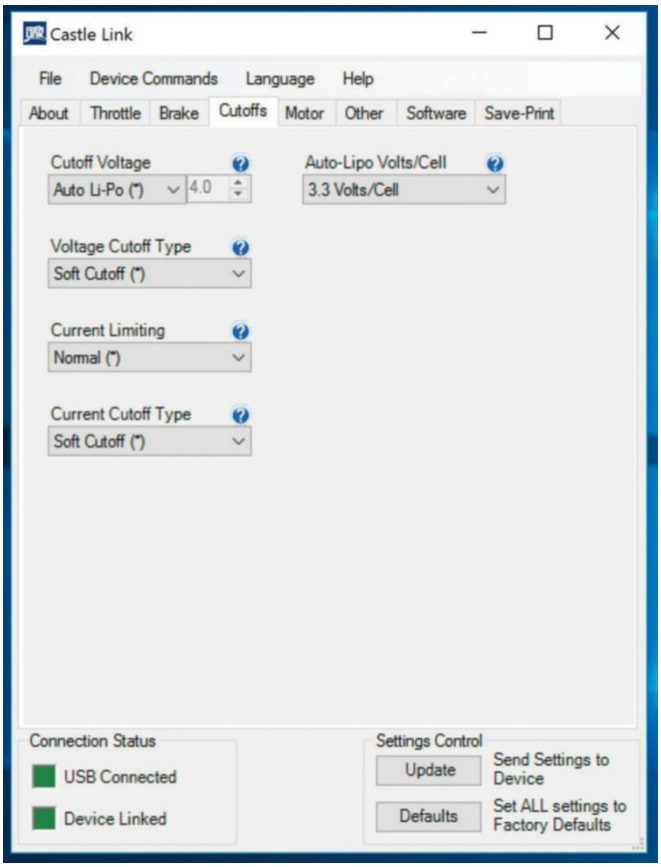
The Castle Link USB Programming board is tiny, barely larger than a servo plug, but it allows programming and firmware updates for Castle Creations speed control via Castle Link Windows PC software.

THROTTLE

The Throttle screen has two settings for airplanes: Throttle Type and Throttle Response. The choices for Throttle Type are Fixed Endpoints and Auto-Calibrate Endpoints. I always use the Fixed Endpoints option and adjust the endpoints in my transmitter so that it takes full-stick travel to move the throttle from off to full. The Auto-Calibrate Endpoints option



The throttle setup screen is easy to use. Throttle options are limited by vehicle type, so deal with that selection first. The grayed-out settings are not available for airplanes, so there's no need to worry about them.



The Cutoffs page is where voltage and current protection are set up. As shown here, the voltage cutoff has been raised to 3.3V from the default 3.0V, with the intent of extending battery life.

requires you to go to full throttle every time you arm it so that the speed control can learn the maximum stick travel. I feel like taking a motor to full throttle on the ground before every flight is a bit much, and using Fixed Endpoints only requires that to be done once during the initial setup.

The Throttle Response setting is fairly straightforward and sets the rate of change from one throttle setting to the next. The default option is Medium and feels just about right for most airplanes. I did find it to be a little sluggish in my Legacy Aviation Turbo Bushmaster, and changing it to a higher number made the throttle quicker to respond and made the plane more fun to fly.

BRAKE

The brake is a function that stops the propeller. The default setting is "off," which allows the propeller to freewheel at idle and is perfect for most planes. The only time I've wanted to change this is when setting up a powered glider that had a folding propeller. If the brake didn't stop the propeller abruptly, it wouldn't fold and the resulting drag would bring the glider down too quickly. I changed the Brake Strength setting to 100% with no delay, and the prop folded right up every time.

CUTOFFS

The Cutoffs page is where protection limits are set for the battery and speed control. Cutoff voltage is intended to prevent overdischarge of the batteries, and the default is called "Auto LiPo." I've never used any other setting here. Auto LiPo uses the Auto LiPo Volts/Cell setting to set a safe cutoff voltage for the number of cells in use. I always increase that Volt/Cell setting from the default of 3.0 to 3.3 volts per cell, simply to

A simple, inexpensive battery discharger can be assembled from common hardware-store items.

DISCHARGE BULBS

Disposing of damaged or old LiPo batteries is something many of us have had to deal with. I like to take mine to a local battery shop that saves them for recycling, but I worry about taking them in if they're still holding a charge. I've never had a reliable and easy way to discharge them all the way to a completely discharged state—until recently.

Tim McDonough, an old friend from early electric-flight days, mentioned this device in an email discussion recently. It has the advantages of being inexpensive and easy to assemble and use, and it is made from commonly available parts. All that's needed is a weather-sealed light socket and a 12-volt, 50-watt lightbulb. I bought both from a local home-improvement store. Simply install your favorite battery connector to the socket wires and screw in the lightbulb.

A single bulb will work for up to a fully charged 3S battery, or two in series for up to a 6S pack. For a larger load, you can combine a couple of the bulbs in parallel. Remember to always charge and discharge LiPos in a safe location.

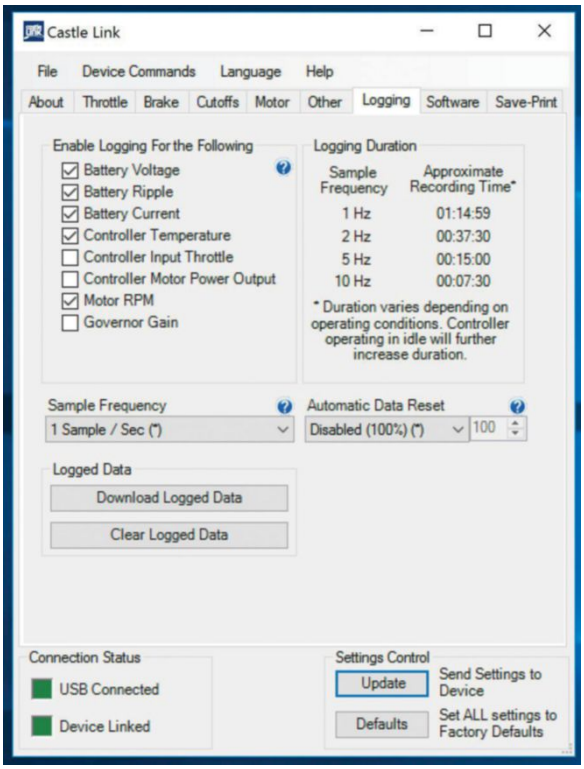
ensure that I don't damage my batteries by overdischarging them. I don't normally get anywhere near that, so the higher setting has never been a problem.

Current limiting is in place to avoid damaging the speed control by pulling too much current due to an overload. The default settings here have never caused me any problem, and I suspect the engineers at Castle know far more than me about where that should be set.

Both the voltage and current cutoffs have a setting to change the way the speed control shuts down or warns you of the cutoff. A hard cutoff is the most severe, a complete shutdown that can be reset with the throttle stick. I think the default soft cutoff, which reduces throttle and thus power levels, gives enough warning without being too harsh.

LOGGING

The data-logging page is an important part of the speed-control setup process. It allows the user to set up the logging frequency, in samples per second, for a list of different power-system parameters. Everyone will likely have different preferences here, but the



The Logging tab offers options for the data-logging function of Castle's ESCs. These data logs are invaluable for model setup, and monitoring them for changes helps maintain electric power systems.

following are mine. I always log battery voltage and current, which I can then use to calculate total power. Controller temperature tells me how effective my cooling vents are and can warn of other problems in the power system. I log motor rpm mostly for fun. Battery ripple can be an indicator of power-system problems, like overload or a bad battery, so I always log and check that. As the help files in the Castle Link application say, low ripple is always better.

In addition to the items to be logged, the Logging section sets up the frequency of sampling. The more often samples are taken, the bigger the resulting data file and the shorter the possible duration of logging. I rarely set mine to a higher frequency than one sample per second, and on the new Edge HV 120, that allows for about an hour and a quarter of logging duration given my data choices. The Automatic Reset setting allows for the speed control to erase all the stored data and start over when it gets to the set percentage to ensure that the most recent flight is always logged. I've started setting this to 90%. That gives me the biggest data file that still allows for the automatic reset.

FINAL THOUGHTS

Setting up a speed control with parameters other than the default may not always be necessary, but it's pretty handy to be able to do it easily when it is. Being able to fine-tune things to suit my style of flying is pretty nice too, and data logging has helped me solve power-train problems several times. If you use Castle Creations' speed control and haven't looked into this programming capability, you're missing out.

FLORIDA JETS

ALL GROWN UP AND NEARLY PERFECT!

TEXT & PHOTOS BY **RICH URAVITCH**

Wow, can you believe it? Florida Jets just celebrated its 21st birthday and *MAN* has brought you coverage since the beginning. Promoter and event originator Frank Tiano conceived the annual Florida Jets as a means of bringing RC enthusiasts with a penchant for jet models together for an exchange of ideas, and he wanted the event to be truly exciting for both enthusiasts and spectators—even those not involved in the hobby. It has grown dramatically and, along the way, has also become a showcase for RC jet manufacturers and suppliers. Frank told me that this year, as in the past, I could count on a few surprises, so I was anticipating exciting and entertaining things—and I wasn't disappointed. The well-known Paradise Field in Lakeland, Florida, with its 60 x 700-foot asphalt runway (one that any RC club would be proud of) is the site for this and other Frank Tiano Enterprises events, including the world-famous Top Gun Invitational Tournament. The flightline, vendors' booths, suppliers, and food stands were all laid out to allow everyone to easily get to their intended destinations. The field's connection to full-scale aviation is demonstrated by the fact that it is also the site for the annual Experimental Aircraft Association's Sun 'N Fun International Fly-In. Lots of aviation activity here!

Florida Jets employs a "fly-in" format rather than that of a contest, so participants are pretty much free to fly as much as they'd like. There is no judging (except for special award trophies) or scoring—just pure jetting around a near-perfect Florida sky. This year, however, opening day was unseasonably chilly for the event, so those coming from northern climes were already acclimated and those of us "native transplants" suffered a bit! Day two and beyond had the temperatures moderating to nearly ideal levels. The breeze was light and steady but right down the runway, allowing some of the larger, heavier models to touch down at barely above walking speed without being challenged by the more common crosswind.

COST OF ADMISSION

One thing was quite clear to me and to others I spoke with as I wandered around the four-day event: Jet modeling, at this level, is not for the faint of heart or shallow of pocket. Making a rough-cost estimate of the "typical" jet on hand, I came up with an "average" number of $7–8K. That's on the ramp, ready to go. Think I'm kidding? Do the math: "kit," turbine system, retracts, brakes, radio, gyros, and other goodies; the number is easy to

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The T-One Models team performs a low-level formation pass.

verify. Now, some guys prefer to have someone else, with perhaps more experience, put all these components together to produce a ready-to-fly package. Add $$ for this service and $10K becomes a pretty realistic number. Talking with a lot of the participants, however, I concluded that cost is rarely part of the conversation. It's not used as a yardstick by which anything is measured. In spite of the costs involved, the people who pursue this segment of the hobby enjoy their pursuits just like the people who fly their foam ducted-fan model on the weekends. And that's as it should be, right?

There was a broad range of RC jets, from a T-One Models sport jet through the new F-1 Mirage—and just about everything in between. The crowd loved it!

NOT YOUR AVERAGE ARF

Equally evident, and just plain amazing, is the availability, diversity, and degree of prefabrication of the jet kits of today. A relatively small number of manufacturers and importers have found a ready and growing market for some incredible projects. Nearly all of the current offerings come not only as premolded structures but also with all the panel and rivet detail (on the scale subjects) crisply molded into the composite surface. The latest feature for these new-generation jet products is the incorporation of the color scheme and trim of your choice, applied directly into the mold during the fabrication process. No painting or further surface preparation necessary! In spite of that, don't let this level of sophisticated prefabrication lead you to believe that the term "ARF" applies to these models. There is a significant amount of work still to be performed, but much of it is really a systems integration effort rather than traditional building and finishing requirements. So, OK, turbine-powered models are not for everyone. I get it. But you don't have to own one to appreciate the level of sophistication some of these models represent. Regardless of your position on building versus assembly, someone had to do all the work necessary to make products like this available. All that "work" includes design, engineering, fabrication, and component integration to

CARF produced the kit, Thomas Singer supplied the effort to complete his Thunderbird F-100, and this was the result: a Critics' Choice runner-up.

"*THAT'S* THE SPIRIT!"

Amazing B-2 Stealth Bomber

This is the cockpit area of the B-2. It seems like an awful lot of full-scale airplane for two aircrew; multiple onboard computers help!

You're probably saying "No way," right? Designing, developing, refining, flying, and kitting a twin-turbine-powered scale model of the Northrop Grumman B-2 "stealth" bomber was not likely to become a reality in the RC scale world. I guess Andreas Gietz, head man at CARF Models (carf-models.com) out of Thailand, didn't share your skepticism! After a significant gestation period of the model, he has nailed it with a design that looks awesome, flies extremely well, and can only be considered a showstopper.

For those of you who are unaware, a flying wing requires some unique, sometimes unorthodox, design considerations to be successful at sustained controlled flight. Jack Northrop discovered many of these requirements back in the late '30s and worked hard at solving the difficulties. The B-2, beyond its planform, bears little resemblance to the early Northrop adventures. Unlike its forebears, it has no conventional vertical stabilizers to make yaw control a little less sporty. Rather, it depends on an extremely complex system of fly-by-wire control to connect the aircrew to the control surfaces and devices. It's the same with the model: It uses a pair of gyros working both in conjunction with—and independent of—each other, depending on the requirements or demand.

Andreas got his team together, accepted the challenge and gave scale jet modeling one of the most spectacular efforts to be seen in a long time. His B-2 Spirit has a span of just over 14 feet, is 65 inches long, weighs 52 pounds, and uses a pair of JetCat 100 turbines to quietly negotiate airspace. It's a remarkable model and the result of amazing perseverance and "can-do" attitude.

Here is the B-2 Spirit stealth bomber from the CARF kit, with designer/builder Andreas Gietz. Better hurry—the kit is still available!

Extraordinary Formation Flying

So you're out at your local field one relaxing Sunday morning, watching Wendell, Dexter, and Stan chasing each other around imaginary pylons with their .90-powered, .40-size racers, and you're thinking, "Wow, the fun factor of this hobby really goes up when you're sharing the sky with someone with the same purpose in mind!" Just then another flying buddy says, "Wouldn't it be cool if four or five of us got the same models and flew them in formation like the Blue Angels or Thunderbirds?" It sure would, but it's not likely to happen. Flying RC models in formation is harder to do than with full-scale planes simply because the participants are not in the cockpits with reference points on their airplane indexed to points on the next guy's. When he accelerates, you match it; when he starts climbing, you climb—all the time keeping your reference point precisely on the spot on his airplane. It's not quite the same thing when all the fliers are on the ground, guiding their models through three-dimensional space!

Providing proof that it can be done was the demonstration performed during the halftime show by the Elite Aerosports team (eliteaerosports.com) with their ginormous new Havocs. Just watching these six models performing formation-type flying was impressive, especially to the observers with RC experience who realized just what it took to accomplish. The low, slow, "dirty" flybys were eye watering. Remarkably, the group had not flown together like this before the event! Granted, none of them was a "Sunday sport flier" and each was outstanding on his own, but to get together with nearly identical airplanes and perform as they did—wow! Hats off to Pablo Fernandez, Michael Abraira, Ali Machinchy, David Shulman, Azza Stephens, and Joey Tamez for an outstanding performance, which has got to be an RC jet milestone! One can only guess what it will look like if they ever get some practice time together!

As if an impressive six-ship flight demo wasn't cool enough, how about these two Havocs formation *landing*, all dirtied up with the noses being held up to bleed off air/ground speed! They make it look easy.

A low-level pass by a pair of Havocs—one upright, one inverted—while some of the remaining team guys return their machines to the pits.

Six—count 'em, six!—of the new Havoc jumbo jets fly in formation. This is the latest offering from Elite Aerosports, flown by some of the best sticks around!

Elite Aerosports jumbo jet drivers put on a fantastic display of formation flying with their Havocs. It was fantastic, especially since they don't fly together regularly!

This is CARF CT-114 Tutor, in Canadian Air Force Snowbirds demo team color scheme, on final. Andy Kane is driving!

make it happen. Some great examples of this were seen in models like CARF's new B-2 Spirit bomber (see sidebar), Jim Martin's wing-swinging F-14A Tomcat, Andy Kane's Canadair CT-114 Snowbirds Tutor, the flock of new Elite Aerosports Havocs, the slippery-looking House of Power Swordfish sport jets, plus many others. Not much traditional (read: "wood") construction around, although one notable example was the unique Douglas F4D Skyray, or "Ford," flown by Joe Saitta, which seemed to be a blowup of the old Berkeley DF design of 1950s. It's living proof that good designs endure, and there's something in the jet world for nearly everyone!

ON THE FLIGHTLINE

Another great thing about this event is that all that gorgeous eye candy is not static. There was some really exciting flying going on with nearly everything that was on hand; there were very few "hangar queens." Among the standouts (in my mind, anyway) were the halftime performances. Franco Di Mauro flew his true-3D-capable jet Rafale, with which he performed some truly amazing maneuvers, including a nearly motionless vertical hover mere inches off the ground. Jim Martin provided an impressive display with his Skymaster swing-wing Tomcat, demonstrating the entire flight envelope of the model. And last but not least was the dazzling formation flying of the six Elite Aerosports Havocs (see sidebar). I was also impressed by the quality and workmanship of a pair of F-100 Huns: one that Trond Hammerstad built and Scott Marr flew, the other by Thomas Singer (Best Scale Jet award recipient). These represented two of the most scalelike Super Sabre models I've seen in a long time and were truly remarkable accomplishments.

This is Jim Martin's fabulous F-14 Tomcat from the Skymaster kit. He really showed the speed range of the model, with wings both swept and extended.

SPECIAL AWARDS

Best Scale Jet	KingTech Turbines	**Thomas Singer**	F-100
Best Scale Jet (runner-up)	Zap Glue	**Rei Gonzalez**	MiG-15
Best Sport Jet	Horizon Hobby	**Pablo Fernandez**	Elite Havoc
Best Sport Jet (runner-up)	CARF Models	**Azza Stephens**	Elite Havoc
Best Sport Jet Performance	Dreamworks RC	**David Shulman**	Elite Havoc
Best Scale Jet Performance	*Model Airplane News*	**Ali Machinchy**	F-104
Electric Jet Performance	House of Power Hobbies	**Rod Snyder**	F-80
Best Multi Jet Performance	Elite Aerosports	**Jim Martin**	F-14
Best Craftsmanship	BVM Jets	**Scott Marr**	F-100
Most Outstanding Jet Flight	Jet Central Turbines	**Franco Di Mauro**	Swordfish
Just Plane Crazy	Cortex Demon Gyros	**Andreas Gietz**	B-2
Super Suave Award	Fly Girls	**Azza Stephens**	–
Special Recognition	JetCat Americas	**Greg Arnette**	Mirage F-1
Special Recognition	EZ Balancer	**Jose Melendez**	Fiat G-91
Special Recognition	Best in the West Jets	**Tim Len**	A-4
Special Recognition	PowerBox Systems	**Mike Saryz**	F-15
Special Recognition	Sport Flyer	**Rob Lynch**	F-16
Special Recognition	Spektrum	**Rei Gonzalez**	F-84F
Critics' Choice	Zap Glue; *Model Airplane News*	**Andreas Gietz**	B-2
Critics' Choice (runner-up)	Horizon Hobby	**Thomas Singer**	F-100

SEE YOU NEXT YEAR

This event is a must-attend for anyone interested in RC jet modeling. It is a showcase for the leading edge in aero miniature technology from fabrication, propulsion, machining, and finishing standpoints as well as home to some of the best jet flying to be seen anywhere. It has always been a truly great jet event, but there was something about this year's atmosphere that made it the best yet. I felt, as did many others, that this was the friendliest, most laid-back, and most fun Florida Jets ever! You found those participating to be knowledgeable and willing to freely share their experiences and offer sound advice to the novice.

Jets, especially the turbine-powered variety, are clearly not for everyone. The fun factor can be obtained from far less sophisticated, alternatively powered jet models without the price tags associated with the kero burners, but if you've got the price of admission, it's the closest you're going to get to strapping on a full-scale jet. From a spectator standpoint, it doesn't get much better, and the crowds at this year's Florida Jets bore that out.

The Jet 3D performance by Franco Di Mauro was amazing. His Rafale showed both the differences and the similarities between the more widely seen gas-powered 3D planes and jets.

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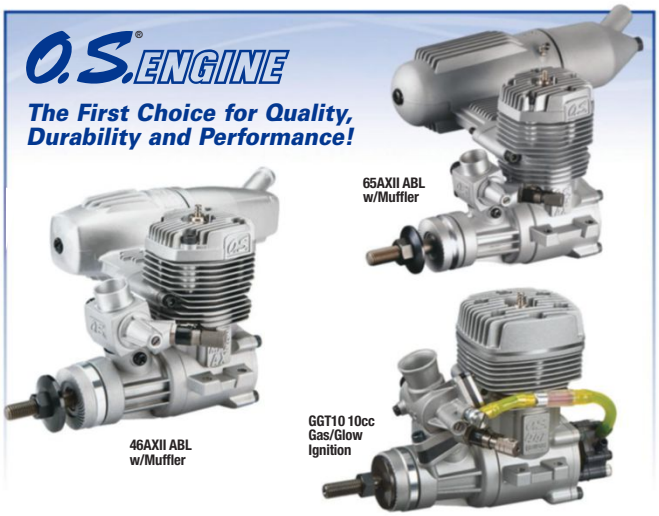

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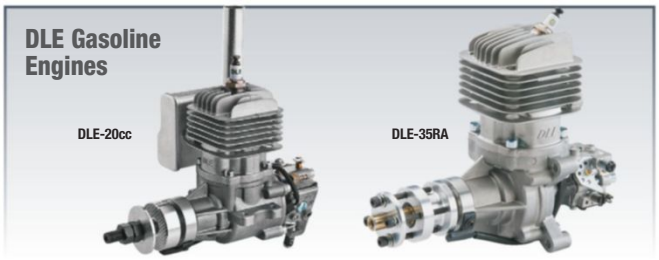

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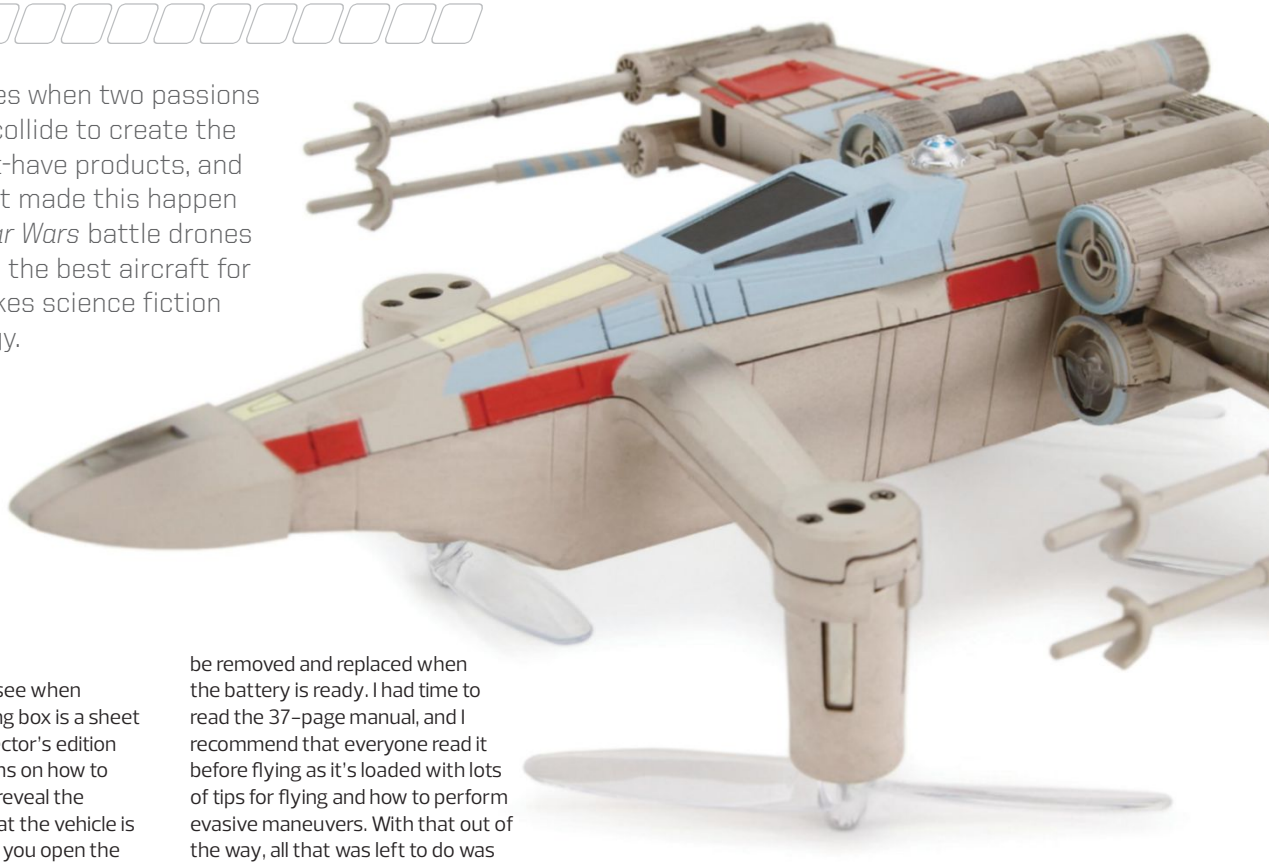
Propel *Star Wars* Battle Drones

The perfect drone for any *Star Wars* fan!

BY **JOHN REID** PHOTOS BY **CHERYL MALTBY & JOHN REID**

There are times when two passions just seem to collide to create the ultimate must-have products, and Propel has just made this happen for me. Its *Star Wars* battle drones are just about the best aircraft for anyone who likes science fiction and technology.



HIGHLIGHTS

The first thing you see when opening the shipping box is a sheet describing the collector's edition box with instructions on how to break the seal and reveal the display platform that the vehicle is mounted on. When you open the box, the display comes alive with lights, music, and sound clips (each time that it is opened, a different clip plays!).

There are three different *Star Wars* drones available, and each is hand painted (so no two are exactly the same) and has a unique serial number. The models are the Tie Advanced X1, 74-Z Speeder Bike, and the T-65 X-Wing, and each comes with the appropriate transmitter and two unique battery packs. Also included are a charger, a protective training cage (for new pilots), extra propellers, a propeller multitool, spare parts, and a nicely written manual.

The first thing I did was to start charging the battery packs, then I installed the props onto the drones. Each drone comes with a faux battery cover that is used when it is in the collector's box; this will be removed and replaced when the battery is ready. I had time to read the 37-page manual, and I recommend that everyone read it before flying as it's loaded with lots of tips for flying and how to perform evasive maneuvers. With that out of the way, all that was left to do was to get another pilot and start my combat missions.

AERIAL RECAP

If you've never flown a quad before, you will want to snap on the protective cage for your drone and turn on the T-mode, which is intended to help ease new pilots into flying. When the drone is in this mode, it is governed by an invisible ceiling of approximately 6 feet and a "floor" that prevents the ship from touching the ground. The drone will also take off and land by itself (when instructed to do so). This is a great mode for anyone's first battle flight.

With the T-mode disabled, the drone can perform some radical moves with speed. Your controller has two buttons that allow the drone to perform either a clockwise or counterclockwise roll. In addition, you can speed the drone up three

THE T-MODE IS INTENDED TO HELP EASE NEW PILOTS INTO FLYING. WHEN THE DRONE IS IN THIS MODE, IT IS GOVERNED BY AN INVISIBLE CEILING OF APPROXIMATELY 6 FEET AND A "FLOOR" THAT PREVENTS THE SHIP FROM TOUCHING THE GROUND.

Each battle drone has its own unique flying characteristics and look. In addition to these three, the Millennium Falcon will be coming out in the spring of 2017.

AT A GLANCE

MODEL
Star Wars Battle Drones

MANUFACTURER
Propel (propelsw.com)

TYPE
Mini battle drones

SIZE
80mm

ASSEMBLY TIME
10 minutes

FLIGHT DURATION
5 to 7 minutes

CAMERA QUALITY
Not applicable

PRICE
$199.00 each

WE LIKE

- Display case
- Hand-painted designs
- Easy to fly and great flight performance
- Battle tallies on the transmitter

***Star Wars* fan or not, you will have a blast flying these quads.**

Let the Battle Commence!

After learning how these birds fly, you will, of course, want to head into battle. After all, isn't that why you signed up for the rebellion flight school? First things first: Protect your belly! The infrared receiver for each drone is located on its underside. Practice maneuvers that allow you to drop behind and slightly lower than the enemy. To help, each manual has a number of different maneuvers for each vehicle. In most cases, you will score a hit if you are two to three meters away because the transmitter sends a wide signal. When you fly outside in bright sunlight, the signal distance is greatly reduced, so you will have to fly closer to your enemy. When flying inside, however, the signal will bounce off walls, especially white ones. The plan of attack here is to stay close to the center of the room so that there is less chance for your opponent to score a hit. Hopefully, you will be able to push them to the outside of the room so that you can score the ricochet shot from the wall. Now that you're armed with that knowledge, get out there and attack those battle drones!

levels for some quick and fast flying, especially indoors. Throughout, *Star Wars* music plays from your transmitter for that little bit of extra inspiration.

The object is to get three hits on your opponent before he or she can score three hits on your aircraft. When you score the first hit on an aircraft, it will rock back and forth. The second hit will cause it to rock back and forth a little longer and with a bit more intensity. The third and final score will cause the aircraft to auto-land in a spiraling downward direction. After 10 seconds of no activity, the ship will reset and be ready to fly again. All three *Star Wars* battle drones have solid flight performance in the air and respond well to stick inputs. Pilots of all skill levels will enjoy flying these drones.

BOTTOM LINE

Having battle drones that resemble *Star Wars* vehicles is very cool, but add in the sounds, music, lights, and the maneuverability and flying speed and you are going to have a great time with these drones. Whether you are a new or veteran pilot, into *Star Wars* or not, these drones are a lot of fun to fly. Be sure to get at least two!

Each unit has a matched transmitter that plays the appropriate movie sound clips for the vehicle.

THE OBJECT IS TO GET THREE HITS ON YOUR OPPONENT. THE THIRD AND FINAL SCORE WILL CAUSE THE AIRCRAFT TO AUTO-LAND IN A SPIRALING DOWNWARD DIRECTION.

WINNING HABITS

Pro advice for better flights

TEXT & ILLUSTRATIONS BY **DAVID SCOTT**

Some time ago, I had to adopt a general policy of not accepting aerobatic students into my commercial RC flight school who hadn't previously attended the school's primary solo course. The reason is that there is not enough time in a four-day aerobatic course to both correct a pilot's bad habits and make significant progress in new areas. The intent of this article is to use the history behind this policy to explain why the flying skills of so many pilots plateau irrespective of age or stick time. Doing so will then help you to appreciate some of the essential good habits that enable pilots to keep progressing.

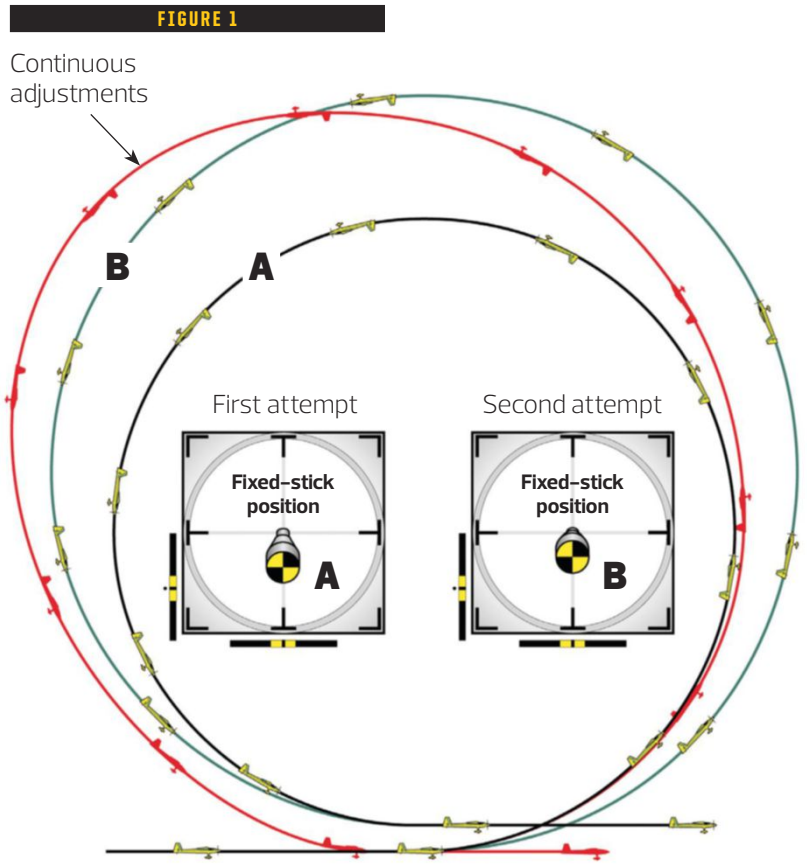
ONE STEP FORWARD, TWO STEPS BACK

During the early years of my flight school, I mainly trained primary students through solo. But over time, the focus has shifted to mostly aerobatic instruction to meet the demand of prior enrollees wanting more advanced training. Along the way, I wrote several training manuals to help students prepare for their courses and to consolidate the training they received. When those manuals were made available to the public, people who hadn't previously attended the school began applying for aerobatic training.

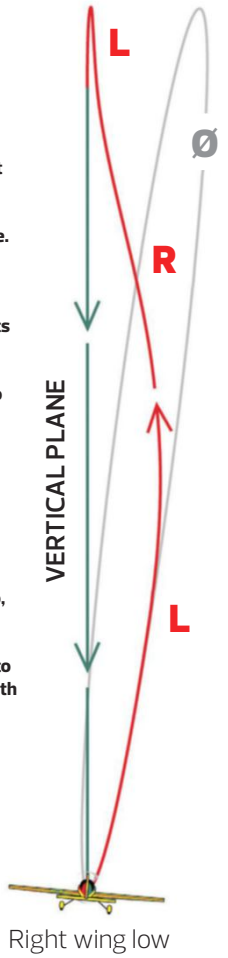
Here's how that worked out: Because very few club pilots follow a detailed syllabus when learning to fly, most estimate their skill level by comparing themselves to other fliers. Just because some pilots fly better than others, however, does not mean that they are flying correctly. (The evidence of that can be seen in the form of inconsistent landings, fear of wind, struggling to learn new maneuvers or adapt to changes, and ultimately stagnant flying.) Hence, people would sign up for the school who considered themselves to be pretty good sport pilots. But upon starting the training, they displayed all the typical bad habits associated with self-taught pilots. As such, their flying was so inconsistent that they proved to be borderline untrainable.

For example, it is fairly easy to correct a mistake that a pilot consistently makes, but it is impossible to instruct someone who does something different each time the maneuver is attempted. Indeed, the instructor's advice (based on the last attempt) would just be

FIGURE 1



If you recognize that the loop is too tight and try to correct it, you will end up with a far poorer result than if you just committed to flying a tighter loop. Worse yet, all the fiddling will cloud your recollection of how much elevator you originally applied and, thus, how much to input next time.



Entering a full loop without the wings level tilts the loop, yet left alone, it will finish generally where it began none the worse. Attempting to fix the loop puts it off-kilter and requires several additional adjustments to complete the loop on the original heading. In addition to further complicating the maneuver, the corrections tend to draw more attention to the original error, causing the loop to appear worse than if no corrections were made. In this scenario, the obvious solution is not to get better at fixing deviations but to always enter loops with the wings level.

adding to the confusion if the student keeps introducing a different set of variables each time the maneuver is performed. The reality is that it is not possible to ignore or try to work around a pilot's bad habits and still make appreciable progress. Their habits have to be corrected before anything new can even be attempted, which means going back to basics.

The funny thing is that these troubled students were always thrilled to finally learn what they had been doing wrong and, as a result, were very happy with the training they received. The problem is that I'm not a big fan of spending the week correcting bad habits. I would much rather be teaching people new maneuvers and how to refine them so that when they return home everyone is impressed by the amount of progress they made in such a short amount of time—hence, the reason for the school policy.

CHASING DEVIATIONS

The origin of bad habits is almost always lack of planning. (The reason it isn't "bad advice" is because bad advice implies that there was some sort of instruction to follow. As a consequence, the results would be fairly consistent. Therefore, the same unfavorable results would, in theory, cause a pilot to recognize the need to change techniques.) The fact is that, unless you and your instructor followed a detailed how-to syllabus when learning to fly, you are essentially self-taught through a process of trial and error and reacting to the plane.

By definition, reactors wait to see a deviation before it occurs to them that a correction is (was) needed. As a rule, it takes far more effort to return the airplane back to where it belongs after a deviation than it does to proactively prevent the deviation. Thus, reactive pilots end up making so many adjustments throughout their maneuvers that it becomes nearly impossible to decipher what caused the deviations or what needs to be done differently next time. Indeed, if the average sport pilot could observe their maneuvers played back in slow motion, they would see that half the time they're correcting their own corrections but are too busy fiddling with the controls to realize it!

The biggest hurdle, however, stems from the fact that no two attempts at the same maneuver ever turn out the same. The resulting lack of consistency sets a progress-killing precedent that causes pilots to assume that constant corrections are standard when flying aerobatics. As such, most pilots believe that the solution to better flying is to get better at reacting to (fixing) deviations. Of course, some become good at it, but only after many hours of practice. Clearly, that approach would never suffice in a four-day training situation.

FIXED-STICK POSITIONS

All that said, it stands to reason that to experience steady progress, you must learn to proactively control the plane instead of merely reacting to it. In short, that means developing a habit of paying attention to the control inputs you make at different stages of the maneuvers. In the May issue, I addressed the importance of initially focusing on the basic step-by-step execution of a maneuver. The point of the article was that while working on the basics, the airplane will show you what tendencies (deviations) are associated with the maneuver and, thus, what corrections will subsequently be needed to improve it.

Everyone knows that "consistency" and steady improvement go hand in hand. The trick to actually achieving consistency is committing to what are referred to in full-scale aerobatics as "fixed-stick positions." That means that, as much as possible, when a control input is made,

lock it in place and don't fiddle with it. If it proves to be the wrong amount, rather than polluting the attempt by trying to fix it, consider it a mulligan and try to learn all you can from the result to do better the next time. In other words, considering that everyone makes mistakes and the only way to truly fix a mistake would be to go back in time and start over, rather than being dejected, turn the mistake into a learning opportunity!

The principle at work here is that it is easy to remedy a consistent mistake. Thus, while it might be true that the whole world will be able to see your mistake, by not fixing it, there also won't be the slightest doubt about what you had done wrong and, therefore, what you need to do differently next time. Otherwise, if you don't like what you see and immediately start fiddling, you will continue to struggle with consistency (Figure 1).

By the way, this tactic is one of the reasons why kids learn so quickly. As students, they're conditioned to making mistakes, especially when learning something new, so they tend not to be anxious to fix everything on the first try. As a result, they give themselves enough time to make the correlation between what they saw the plane do and what inputs they were making at the time. As soon as that registers, their subconscious mind takes over, and they begin to automatically apply the correct inputs every time they are in that situation.

Obviously, if the incorrect input or deviation during the maneuver is severe enough, you'll have to correct it. Doing so, however, diminishes consistency and makes it harder to determine what the original error was. Thus, anytime that my students enter a loop without the wings level or undershoot a 45-degree upline, I encourage them to fly the best tilted loop or 40-degree upline the world has ever seen! They are subsequently always amazed to see how well the maneuvers turn out despite not fixing deviations. You, too, will be amazed if you can hold off, as much as possible, until the next attempt to make the appropriate changes. In fact, many will discover that their mulligans turn out better than when they were previously trying to fly the best maneuver they could.

THE WINNING HABIT

Those who learn to commit to fixed-stick positions not only experience better rates of learning but also have a major leg up on everyone else. In the world of aerobatic competition, for example, there is a saying that "the pilot who makes the fewest moves, wins!" This is obviously a reference to the proficiency of the winning pilot, but it is also a reference to the habit known as "do not fix"—or as I like to put it, "don't make the judges' job easy." What I mean by that is something about a maneuver may not be ideal, but often one or more of the judges won't pick up on it; however, if the pilot fixes it, he or she has made sure that every judge notices his error (Figure 2).

That is actually how a lot of judges judge. Rather than having a keen ability to judge the accuracy of the maneuvers, many judges come up with a score based on how many corrections they observe the pilot make. Therefore, when I teach pilots who intend to compete, I make sure they understand that a first-time competitor can often score well simply by refraining from fixing (telegraphing) every deviation to the judges. This crucial tactic is known as "learning the game" of competition flying.

Consider this: Depending on the situation, if the judges have already downgraded the maneuver because of an obvious error, fixing it might incur additional downgrades from the judges! Indeed, pilots who don't yet know how to play the game often presume that their fixes will make up for earlier deductions (aka downgrades). What they actually end up doing is taking a maneuver that might have scored an "8" and, by adding more adjustments, whittle it down to a "6." Once again, if the error is significant, then it will have to be dealt with, but I would chalk that up to nerves or not

FIGURE 2. HALF REVERSE CUBAN TURNAROUND

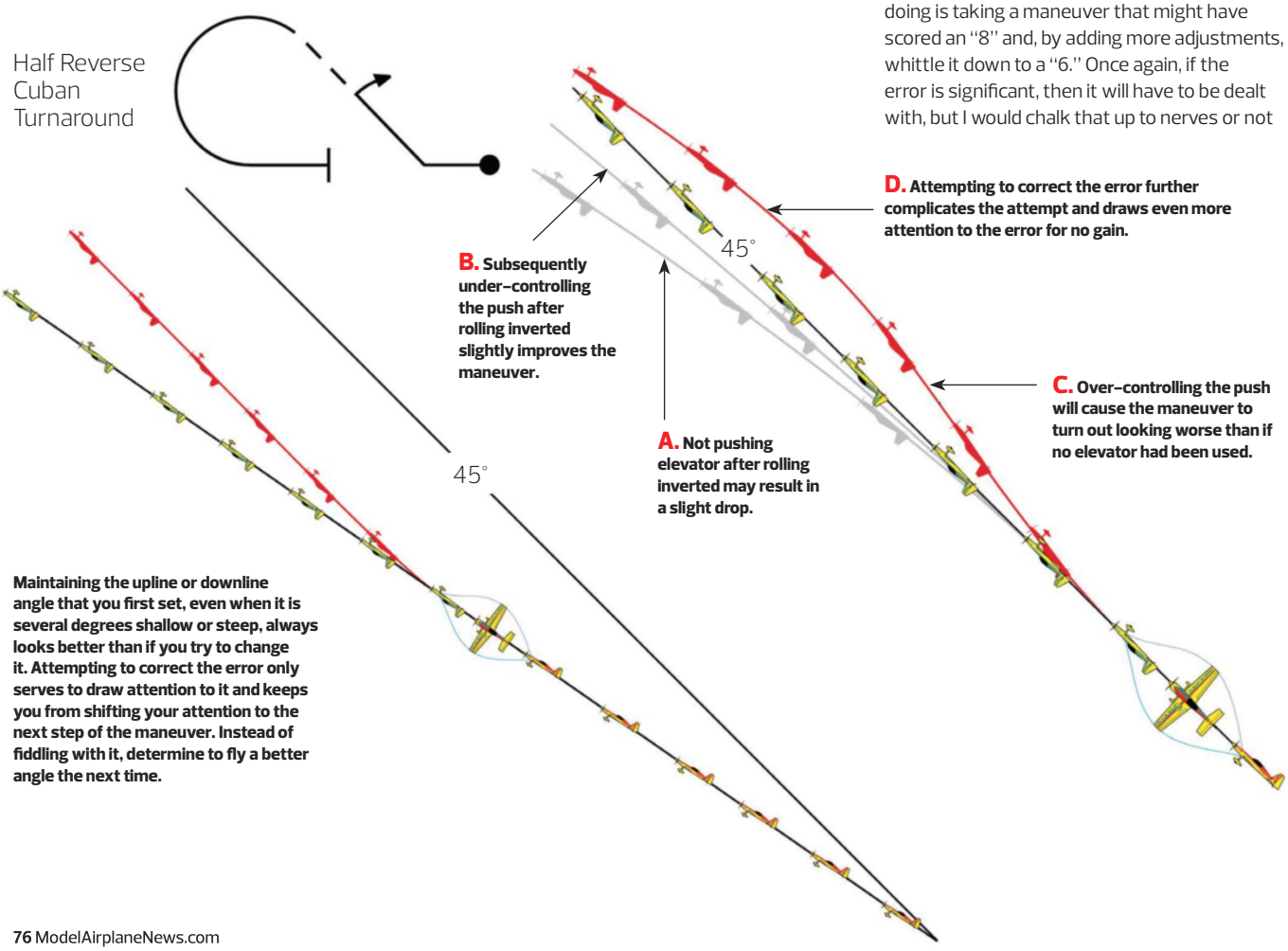
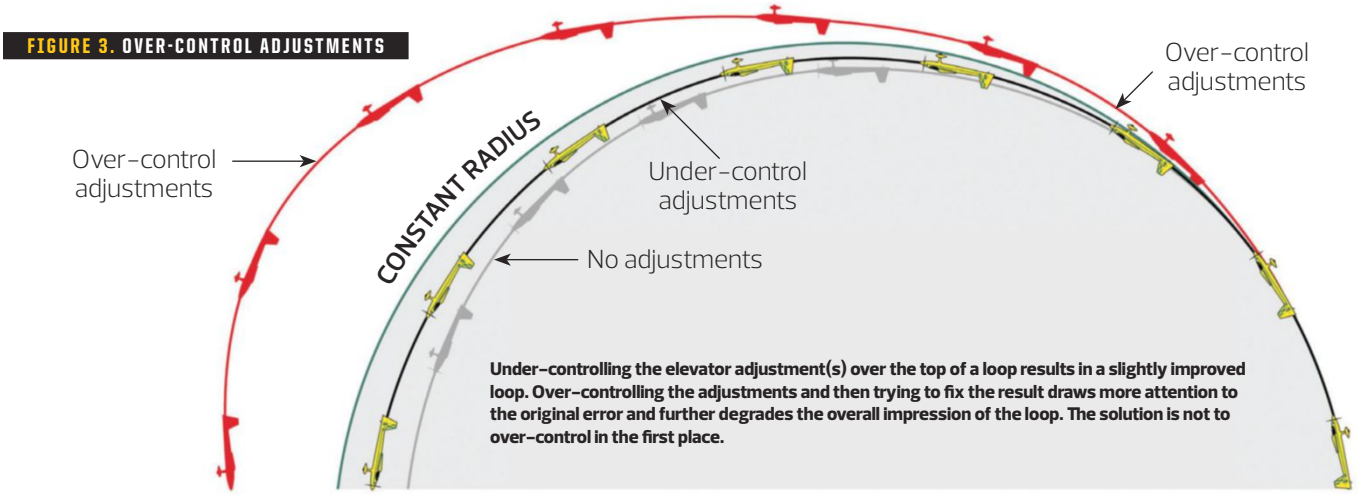
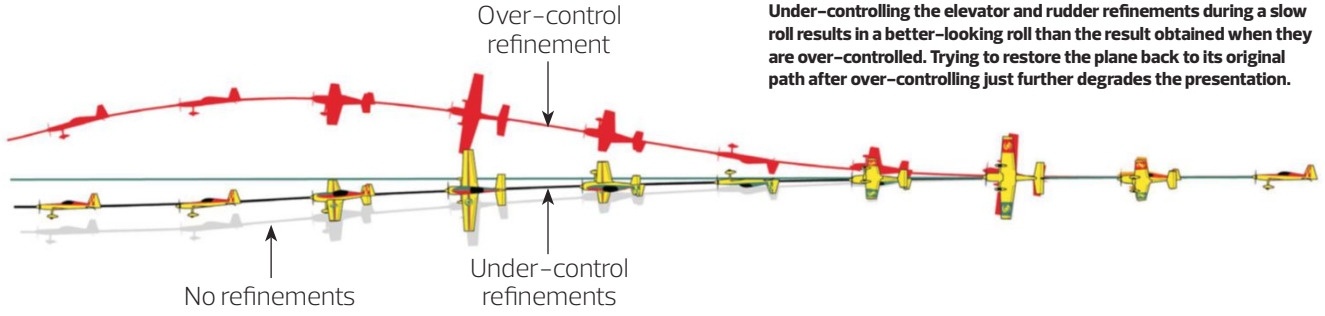


FIGURE 3. OVER-CONTROL ADJUSTMENTS



Under-controlling the elevator adjustment(s) over the top of a loop results in a slightly improved loop. Over-controlling the adjustments and then trying to fix the result draws more attention to the original error and further degrades the overall impression of the loop. The solution is not to over-control in the first place.



Under-controlling the elevator and rudder refinements during a slow roll results in a better-looking roll than the result obtained when they are over-controlled. Trying to restore the plane back to its original path after over-controlling just further degrades the presentation.

being ready to compete rather than a reason to discard this winning tactic. The fact is that a modestly misshapen partial loop or shallow upline won't degrade the overall maneuver—or impair training—nearly as much as trying to fix every deviation.

I think that it is a fantastic coincidence that the same tactic that helps pilots earn a podium spot is the same tactic that accelerates learning! Or as I like to say, even if you have no plans to compete, the best way to consistently ensure favorable results is to practice as though you were going to (and don't want to make the judges' job easy).

"UNDER-CONTROL" TO PERFECTION

As a result of improved consistency, you'll soon begin to pick up on the small tweaks that will enable you to perform the maneuvers nearly perfectly. When it comes to introducing refinements, this next good habit is a total game changer! In fact, if you can commit to it, your maneuvers will turn out so well that you'll want to tell everybody you've discovered to secret to mastering precision aerobatics. It must be noted, however, that it only works to this degree when a pilot possesses the previous good habits.

The habit is this: Whenever inputting a refinement or preventing a deviation and the amount required is not known, try to "under-control" the control input. That does not mean to keep the input small; it means, literally, to try to input too little. It may not always turn out to be enough, but the point is that, if you're going to err, too small of an input is always preferable to too large of one (Figure 3).

This approach is so much more than the vacuous advice to not over-control. It is an active mindset, and this is what you need to understand: If a maneuver using the minimum required control inputs results in a "7" and you set out to under-control the refinements that you add to it (e.g., inputting rudder during a slow roll, adjusting elevator over the top of a loop, pushing elevator when inverted), you might end up with a "9." If you over-control the refinements, however, you could end up with a "4"! Most competitive pilots will tell you that if you can consistently fly 9s, you would win every contest. For those who don't compete, the incentive to under-control refinements is obviously greater pride in your flying.

It takes vigilance to learn this habit because the natural tendency is to keep increasing or reducing the size of the inputs until seeing something change. As a result, pilots end up having to fix their own fixes (hence, the reason why purely reactive flyers are never able to consolidate their refinements). The nature of refinements is that, when they are performed correctly, there is often no indication that an input was made, except for the fact that the airplane flew the proper path. Thus, aiming to initially under-control your refinements is paramount to achieving that objective.

FINAL THOUGHTS

You may be thinking that you have no interest in becoming an expert aerobatic pilot but are happy just to fly sport aerobatics (which is like saying, "I'm not interested in mastering turns or landings, but will settle for mediocre"). Even so, if it takes you a long time to get used to a new plane or learn a new maneuver, if you're uncomfortable flying in winds above 10mph, and if you tend to have good days and bad days, you can chalk up those shortcomings to inconsistent flying. As such, the constant corrections you make max out all your "brain bytes," and it, thus, only takes introducing one new variable to strain your capacity to overcome it.

The fact is that flying is a whole lot more fun when you're doing well and making progress. So if you would like your flying to be more productive and enjoyable, plan to set your normal routine aside for one day (preferably when no one is around) to try out these techniques. Just try not to get mad at yourself when you come to the realization that, all this time, you've been doing things the hard way! Of course, that assumes that your airplane is set up for your particular skill level and that you haven't lost the direct correlation between your control inputs and the response of the plane by going overboard with programming percentages.

HOW TO

Install Electric Retracts

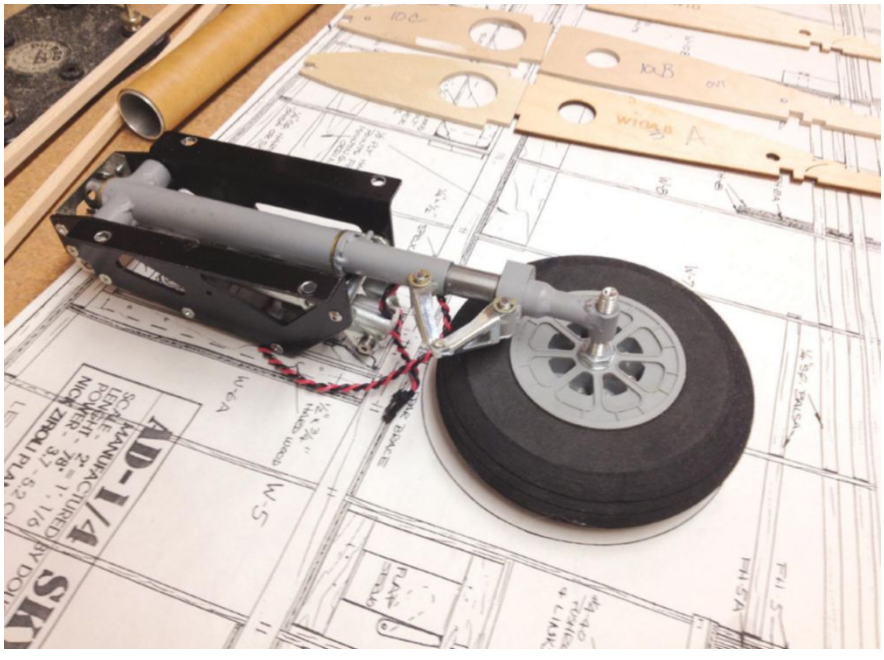
TECHNIQUES FOR ADDING 90-DEGREE ROTATING GEAR INTO A SCALE WING

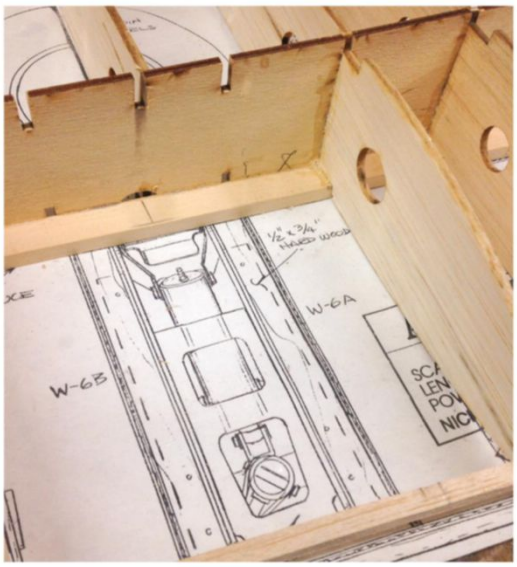
TEXT & PHOTOS BY **GERRY YARRISH**

When you are installing aftermarket retracts in a plans-built airplane project, you have to plan ahead. Installing the main plywood support ribs and mounting rails so that the landing gear end up straight and square to the building board is the most important task. Here's the process I used to install Robart #148E electric-powered gear in my current project: an 85-inch-span version of the Ziroli Skyraider.

WING STRUCTURE

Before the wing was even built, I checked the fit of the Robart #148E gear by laying them in place over the plans. Since the original plans were reduced 15 percent, there was no way to know exactly if the gears' frame would fit properly in width and depth without actually having the units on hand. As you can see here, the fit is tight, but everything does fit without major adjustments to the structure. The only thing that I needed to change was the spacing width between the two main plywood support ribs W6-A and W6-B.





I went ahead and built the two main wing panels without the plywood ribs set in place. Once the basic wing structures were assembled, I then marked the centerline location of the gear struts on the main spar web. Since the W1 and W2 wing ribs have alignment/building tabs on them to keep them properly aligned with the building board, I used a 1/2-inch shim to lift these ribs up off the plans, then I blocked up the wingtip to the proper dihedral-angle height above the building board.

MAKING RAILS

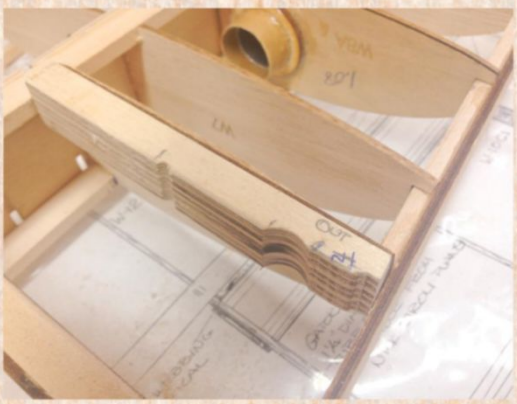
The easiest way I have found to make laminated plywood rails is to use a micro/hobby table saw to rip the plywood, which, in this case, is 1/4 inch thick. Since the plans indicate the need for 1/2 x 3/4-inch rails, I ripped 1/2-inch-wide strips so that I could stack three of them together to produce the required depth. When laminating plywood, use slow-setting 30-minute epoxy and lightly clamp the strips together. Then when the epoxy cures, sand any excess adhesive away so that you have smooth surfaces all around.

Using my Hangar 9 Angle Pro digital level/gauge, I zeroed out the reading on the building board. I then positioned the inboard plywood rib into place but did not glue it. Because of the actual dimensions of the #148E gear (centered on the gear location shown on the plans), the plywood rib did not key into the alignment notches in the plywood spar web. I cut the tabs off the back of the rib and slid it into place.

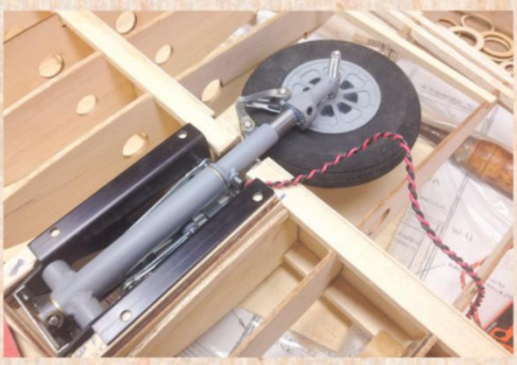
After checking the dihedral angle once again, I used the digital level to position the inboard rib, making sure it was square (90 degrees) to the building board. I also used a square triangle to make sure the rib was square to the plywood web and main spar.

After lightly tack gluing the inboard rib into place, I used the landing-gear unit and the two support rails as spacers to determine the correct position of the outboard rib. The gear fit perfectly between the main spar and the plywood doubler at the wing's leading edge. With the gear in place, I lightly tack-glued the outboard rib into place, making sure it too was square to the main spar. I then cut away 1/4-inch-square balsa leading-edge backing strip to clear the front of the gear frame.

MAKING RAILS (continued)



Once the rib spacing was set, I cut the rails to length and tacked them in place. For the gear frame to sit flat against the support rails, some trimming also had to be done. To clear the pivot bolts and some of the other screw heads, I used a Dremel Moto-Tool and a Robart grinding bit to grind the required areas. Also I sanded a light radius on the inner upper rail corner edges.



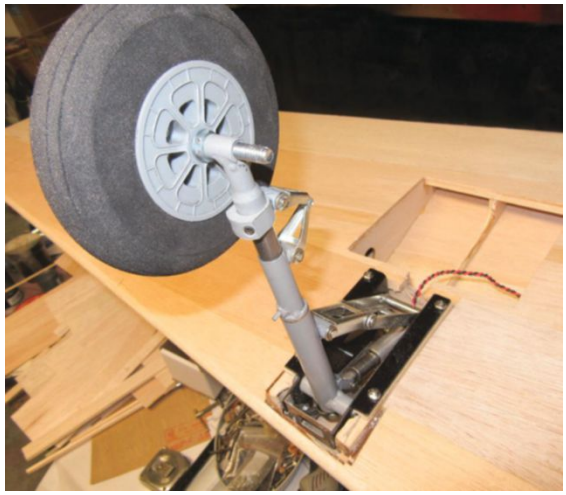
With the gear in the retracted position, I checked the clearance of the strut and the wheel to the main spar. A small half-round portion of the lower spar had to be cut/ground away to clear the strut. With everything lined up, I cycled the gear up and down a couple of times to make sure all the drive mechanisms cleared the wing structures. Once you like the alignment, the rest of the wing sheeting can be applied and the large wheel-well section cut open.

The plans show the support rails being glued flush with the bottoms of the plywood ribs, but with the new reduced wing dimensions, I had to add a 1/8-inch-thick plywood strip to the bottom of the rails. This allowed the top of the gear frames to clear the wing's top sheeting.

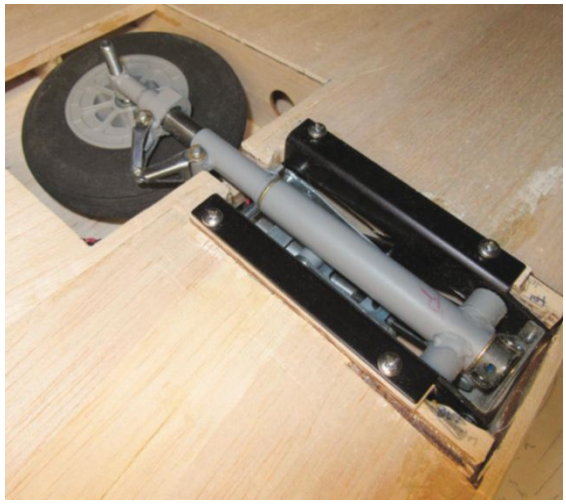
At this point, the two wing panels can be joined together and the wing attached to the fuselage. Once this is done, the gear can be fitted back into place for a final check and the gear attachment rails can be permanently glued in place using 30-minute Z-Poxy. (I used Zap adhesive throughout the build.)

GEAR INSTALLATION

All the building and prep leads to this point where you actually bolt the landing gear into place. I put the gear in place, centered them between the two rails, and marked the rails through the attachment holes. I removed the gear and drilled 1/8-inch holes all the way through the rails. To hold the gear in place, I used 1-inch-long, #6-32 pan-head sheet-metal screws from RTL Fasteners, threading them into place with a large Phillips screwdriver.



I powered up each of the gear individually and cycled the gear, checking the clearance around every possible contact point as they retracted and extended back into the down and locked positions. For this project, the main gear doors will be added after the Skyraider has been test-flown.



With the wing attached to the fuselage and both landing gear in place, the Skyraider can finally be set up on its feet. It's at this point that the project becomes a real scale airplane, not just a bunch of airplane parts.

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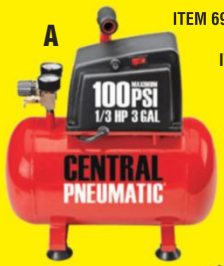

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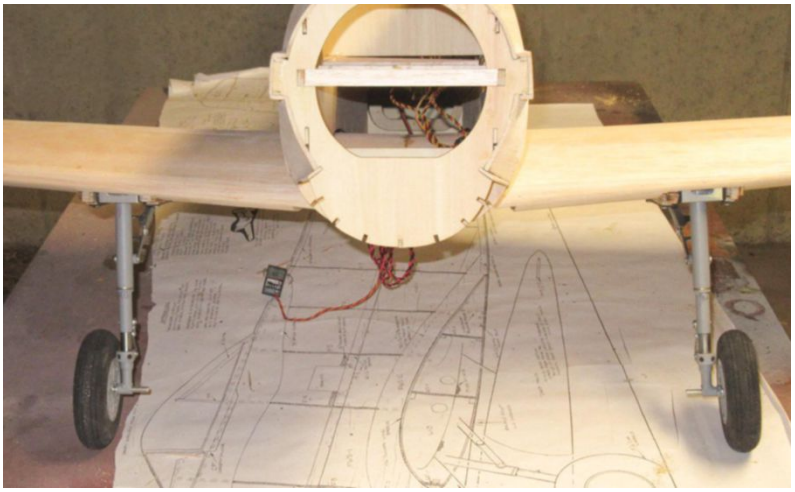

TOE-IN

With the gear in the down and locked position, do a final check to make sure the gear struts are square to the building surface and that they are parallel with each other. If they are not, you can use thin plywood shim strips glued to the attachment rails to tweak their positions. Once the gear struts are 90 degrees to the ground, check the wheel axles' toe-in. ("Toe-in" means that the wheels are angled inward slightly toward the fuselage centerline.) This is important for proper ground handling, especially during landings. The two black setscrews on the axle support fittings are used to adjust and lock in the wheel/axle toe-in angle. Once you dial in the toe-in angle to about 2 degrees, use a drop of Zap Thread Locker and tighten the setscrews.

ROBART #148E 90-DEGREE ROTATING RETRACTS

The rest of the landing-gear installation is internal and includes the main drive controller and wiring. There have been several upgrades, including more secure wire connections and a green LED status light to let you know everything is connected properly. Here are some tips for installing the gear:

- The control unit has three actuator circuits, Units 1-3, to control the two main gear units and a third gear (either a tailwheel or trike nosewheel).
- Position the DIP switches for Type A or B. The Robart Electric Series uses different motor amp-out settings depending on the size, weight, and geometry of the retracts. Type A has a lower amp-out threshold. Typically, smaller retracts and tailwheel units require a Type A setting. (These actuators will have a Type A sticker on the wire leads.) All other actuators are Type B unless otherwise noted with a sticker. When using less than 6.0V, it is recommended to use Type A settings for all retracts.
- If you want one of the gear to be driven with a retract/extension delay to stagger the cycle, position the Delay DIP switch to the Checked position.
- Position the control unit near your receiver and securely attach it in position. For the Skyraider, the receiver is installed in the fuselage and the control unit is attached to the top center of the wing. I use a 12-inch servo extension lead to make the connection to the Gear port of the receiver.

The control unit can be powered by plugging it directly into the receiver or using an auxiliary-drive battery pack. An auxiliary battery plugged into the Aux Bat port (with a charger switch harness) is recommended for larger gear. If the leads on the retract units are not long enough to reach the control unit in the fuselage, Robart has optional 12- and 24-inch extension cable leads available.

OPERATING VOLTAGE

The #148E gear can operate with 4.8V to 9V input voltage, but for maximum performance, you should use 9V. Robart also has a 9V voltage regulator available, which can be used to ensure the voltage remains at proper levels. With the regulator, you can use higher-voltage packs (like 3S 11.1V LiPo packs) to power the retracts.

BOTTOM LINE

That's it! Installing the Robart #148E gear is easy, and they provide reliable performance if you install them properly. Remember: Do not force anything with these gear. If a unit jams, it will amp out and stop; simply flip the gear switch to cycle the gear. Also, make sure your mount rails are straight and parallel to each other so that the units set flush in place. A misalignment while tightening the units into place with the mount screws could cause the gear to bind. If you take your time and install everything straight and true, the gear will give you a long and carefree operational life.

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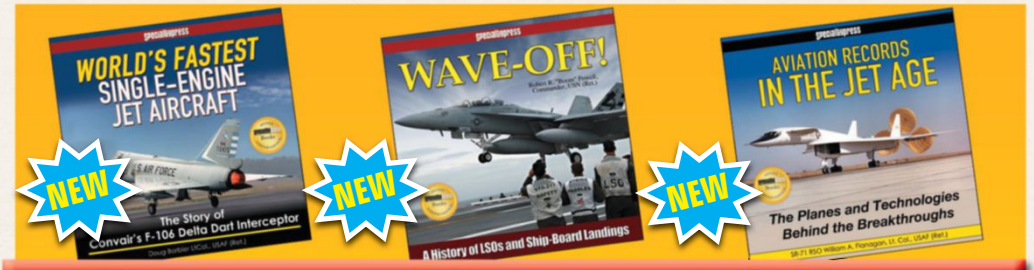

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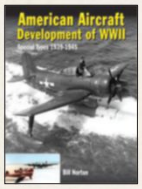

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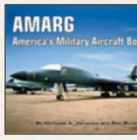

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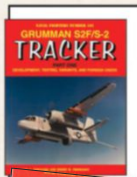

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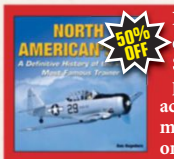

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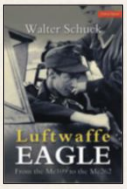

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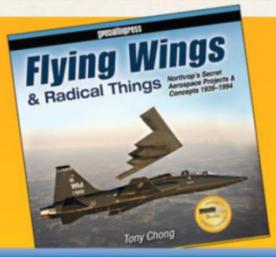

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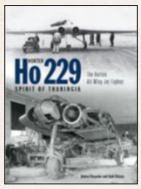

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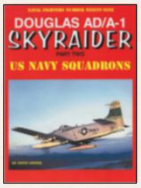

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A great plane to take out to the field for hours of fun cutting through the sky

BY **JASON BENSON** PHOTOS BY **JOHN REID**

The new Sport GP/EP from Tower Hobbies is a straightforward, low-wing design. It can be used as a low-wing trainer, and it performs well enough to please the most discriminating pilots out there. Great performance and clean lines are sure to make this a favorite model in any fleet.

AT A GLANCE

MODEL
Sport GP/EP ARF 60"

MANUFACTURER
Tower Hobbies (towerhobbies.com)

WINGSPAN
60.2 in.

PILOT SKILL LEVEL
Intermediate

ASSEMBLY TIME
6 to 10 hours

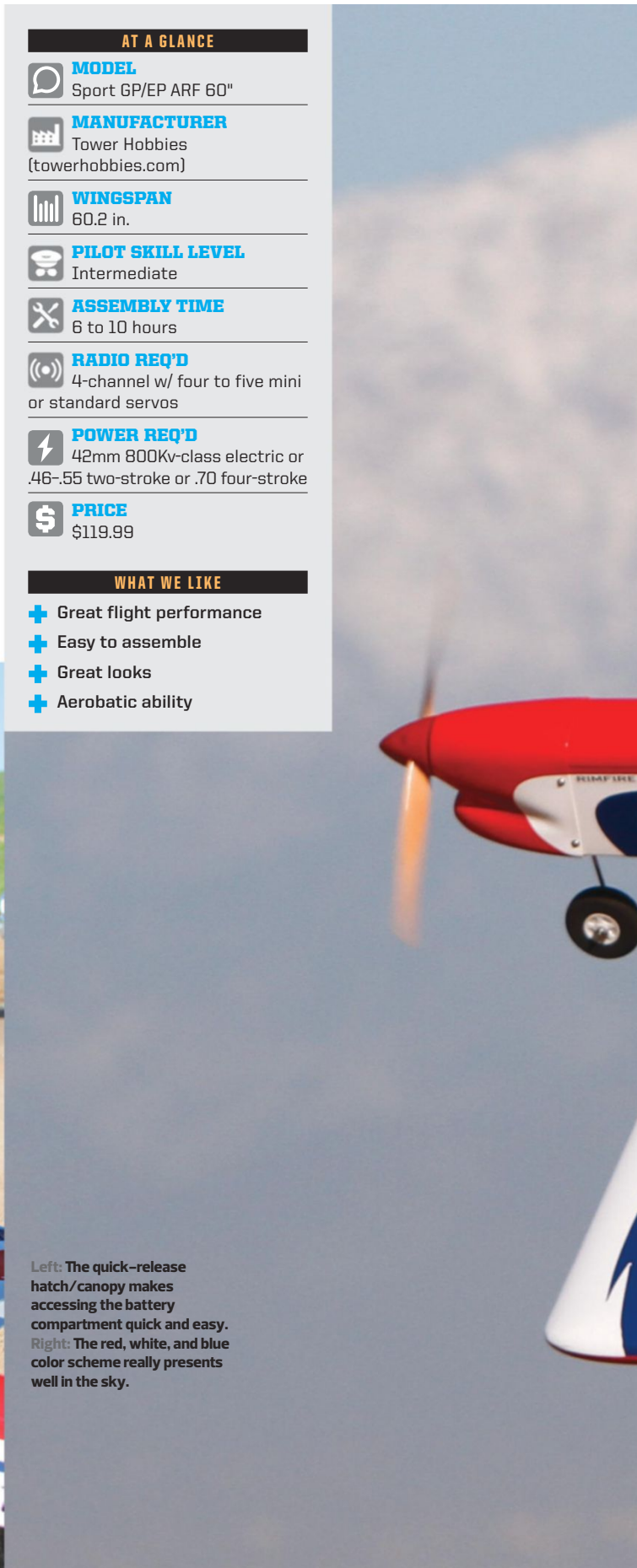
RADIO REQ'D
4-channel w/ four to five mini or standard servos

POWER REQ'D
42mm 800Kv-class electric or .46–.55 two-stroke or .70 four-stroke

PRICE
$119.99

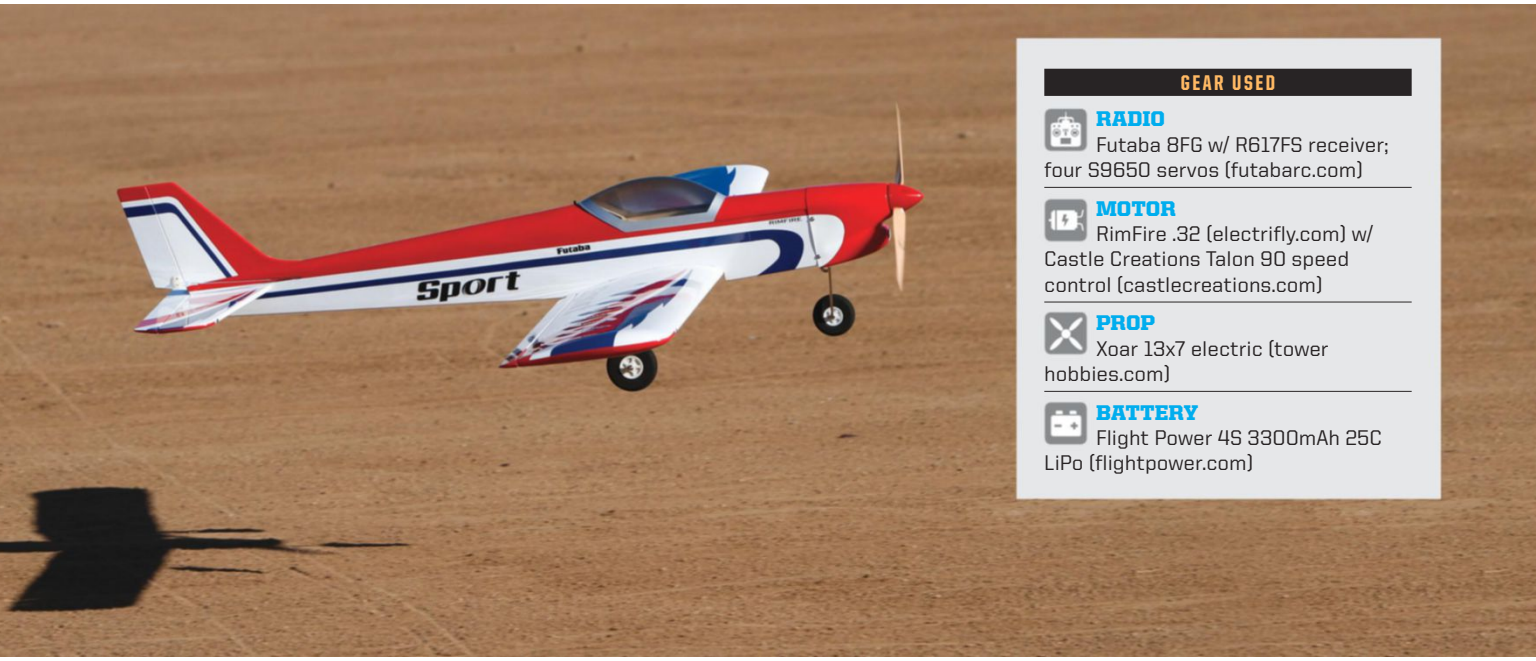
WHAT WE LIKE

- Great flight performance
- Easy to assemble
- Great looks
- Aerobatic ability



Left: The quick-release hatch/canopy makes accessing the battery compartment quick and easy. **Right:** The red, white, and blue color scheme really presents well in the sky.

FROM PERFORMING LOW FLYBYS TO SHOOTING TOUCH-AND-GOS WITH LOOPS AND ROLLS IN BETWEEN, THIS MODEL IS JUST GOOD FUN.



GEAR USED

RADIO
Futaba 8FG w/ R617FS receiver; four S9650 servos (futabarc.com)

MOTOR
RimFire .32 (electrifly.com) w/ Castle Creations Talon 90 speed control (castlecreations.com)

PROP
Xoar 13x7 electric (tower hobbies.com)

BATTERY
Flight Power 4S 3300mAh 25C LiPo (flightpower.com)

The Sport has a built-up airframe with a beautifully matched, prepainted fiberglass cowl. The color scheme is applied at the factory using heat-shrink covering. Everything needed to assemble your new model is included in the box. All you will need is your servos and your electric or glow powerplant. Metal landing-gear legs, pushrods, control horns, motor mount, fuel tank, optional electric motor box, and all screws/fasteners are included and are of excellent quality. The premounted and finished hatch/canopy is also a nice touch.

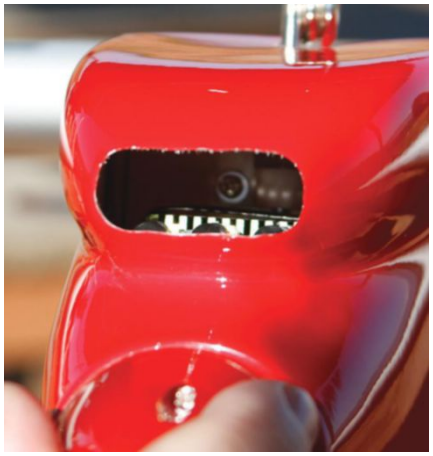
This plane is well suited to any pilot who has mastered a high-wing trainer and is ready to move on to a low-wing sport trainer. Its tricycle landing gear make takeoff and landing a nonevent and will help in the transition to a low-wing airframe.

UNIQUE FEATURES

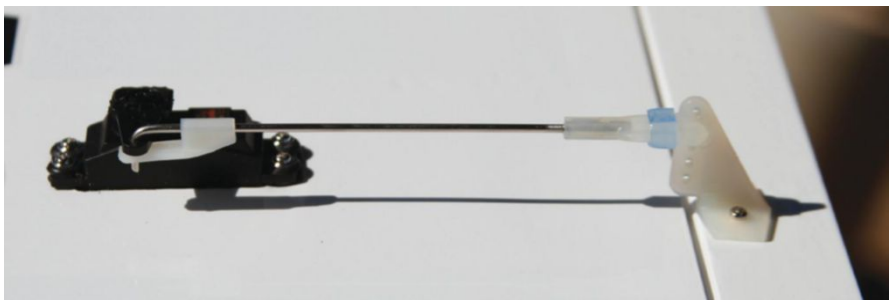
Keeping up with what has become almost standard in the past several years, Tower Hobbies decided to prehinge all surfaces of the Sport GP/EP at the factory. This speeds up assembly quite a bit. The hinges used are flat CA-type hinges that should withstand years of service.

The Sport is a standard full-house 4-channel model. There are no flaps or retracts to worry about, which I find makes this plane relaxing to take to the field and fly. The use of bolts to secure the wing to the fuselage and forgoing rubber bands is also a great feature.

The fiberglass cowl is prepainted, and you only need to final-fit the spinner and drill for the included mounting screws. The canopy/hatch is premounted and finished with a quick-release latch that makes access to the radio compartment and flight battery area quick and easy.



Left: The cutout in the cowl provides plenty of cooling for your speed control or glow engine. Above: A bolt-on wing eliminates the need for rubber bands. Below: Easy-to-set-up pushrods make assembly quick and control precise.



Included in the box is a sheet of decals that allows you to finish off the Sport to your liking. The decals are precut to shape and look great once applied. All the hardware included in the kit is separated into bags that correspond to the different assemblies. All threads are metric, and the hardware is of high quality. There are also a set of foam wheels along with wheel collars that complete the landing-gear assembly.

I made no modifications to the Sport GP/EP. One thing I did find that is worth mentioning is that the cowl seems to be a little short for the RimFire motor I used. I ran out of material to drill through and ended up with about a 3/16-inch gap between the cowl and spinner. This is not a huge deal, but I would like to see a little tighter tolerance. Be sure to check your motor or engine, and plan accordingly. If using a glow engine, you may want to slide it a little farther back than indicated in the directions to keep

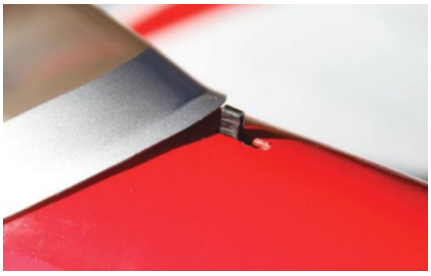
Wing Joining

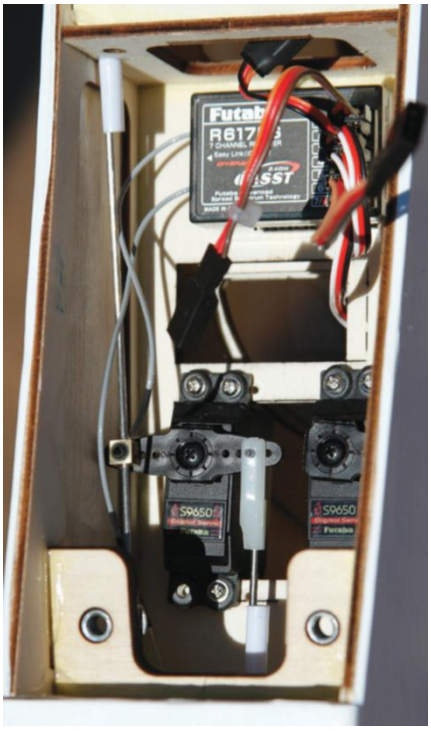
One assembly question I get a lot when I bring out a plane like the Tower Hobbies Sport is how I join the wing without making a mess with the glue.

This really comes down to three things. The first is preparation. I like to use low-tack blue painter's tape to mask off the wing so that glue does not go everywhere. I do this by placing a tape line all the way around the wing on both sides about 1/8 inch from the joint area.

The second is using the correct tools. I like to use an epoxy gun that I got at McMaster-Carr. This helps keep my wasted epoxy to a minimum and helps ensure that I get all the epoxy in the correct place and not all over the wing. This is not an absolute must, but since acquiring this great tool, I have not had any of the epoxy "emergencies" we all dread.

The third is cleanup. Don't wait until the epoxy is almost cured to clean up. If you have your denatured alcohol and squares of paper towel prepped and ready before you begin, you will have a much nicer final product. Make sure to use a few pieces of paper towel. Epoxy will build up and start to be spread instead of being picked up if you are not careful. Once all the excess epoxy is cleaned up, remove the blue tape so that none gets stuck to the wing, and do one last wipe down with alcohol and paper towels.





Above: **The quick release for the hatch comes preinstalled.** **Below:** **The radio compartment has plenty of room for standard radio gear.**

your spinner-to-cowl gap to a minimum.

Tower Hobbies did a great job planning for the use of an electric motor and speed control. I used a slightly larger speed control than recommended/needed for my motor, so I needed to remove the outer plastic case to make it fit. This was of no consequence, and I would not hesitate to do it the same way again.

IN THE AIR

You can fly the Sport GP/EP from just about any model runway. Its medium-size wheels should handle a grass, dirt, or paved runway just fine. The tricycle landing gear provide great ground handling. With a little bit of setup and manual trimming of the nosewheel, tracking down the runway is straight as an arrow.

Takeoffs were uneventful. With the model aimed into the wind, I slowly advanced the throttle and the Sport was airborne before I knew it. When it came time to land, I lined up with the runway and only minor corrections were required to get to touchdown. The Sport would truly make a great low-wing trainer and second model.

GENERAL FLIGHT PERFORMANCE

Stability: The sport is stable, and its light wing loading helps keep things controllable down to walking pace.

Tracking: The Sport has a slightly-longer-than-average tail moment. This makes for a plane that tracks very well. I balanced the plane per the directions and found this to be spot-on. The Sport flew straight and true, going exactly where it was pointed.

Aerobatics: Loops, rolls, avalanches, point rolls, rolling circles, and inverted flight were all handled with ease by the Sport. The recommended RimFire 32 motor provided plenty of power to pull through all maneuvers while still providing plenty of flight time to keep you satisfied.

Glide and stall performance: The Sport has a clean, aerobatic design. It has a respectable glide performance, and when the nose is pulled up to slow down, the stall is gentle and predictable. I did not find any high-speed stall tendencies.

PILOT DEBRIEFING

There are so many positive attributes to the Tower Hobbies Sport GP/EP. As an avid RC modeler for more than 30 years, I still find myself wanting to get this plane out to the field again for more fun. From performing low flybys to shooting touch-and-gos with loops and rolls in between, this model is just good fun. I also find that the Sport stands out at the field. Its color scheme is a nice departure from the straight lines we have all seen over the years on sport models.

BOTTOM LINE

The Sport GP/EP is easy to build and fly, and assembly takes six to 10 hours, depending on your experience and the availability of tools and equipment. I really enjoyed assembling and flying this model as an electric. The simplicity and cleanliness of e-power make for an enjoyable experience taking this plane to the field. ✚

Final Approach

BY **EARL AUNE**

RQ-180 STEALTH UAV

Modeling an unmanned U.S. Air Force drone

I have always been fascinated by flying wings that seem to defy flight as we know it. I was looking for an airframe to use for first-person-view experiments and the advantages of a flying wing kept coming up. Then I read about the RQ-180, the U.S. Air Force's newest top secret intelligence, surveillance, and reconnaissance unmanned aerial vehicle (UAV).

With a wingspan that could reach 130 feet, the R-180 was developed in secret by Northrop Grumman under the Air Force's classified budget. Some quick Internet research revealed the RQ-180 has quite a history already, and it is yet to be deployed (or so we are told). As of this writing, the RQ-180 has yet to be seen by civilians, so the only documentation that can be found is a variety of artist conceptions or blurry photos from unidentified individuals hanging around Area 51.

Therefore, the RQ-180 outline I developed is derived from existing flying-wing designs (B2, RQ-170) and several artist conceptions, including the one on the cover of the December 2013 issue of *Aviation Week & Space Technology*.

Weighing in at just over 6 pounds with a 6S 4500mAh LiPo, this 1/20-scale flying wing has a wingspan of 74 inches and is powered with a 90mm ducted fan. It is constructed out of 2-inch-thick blue insulation foam.

The big question was would this model actually fly? The answer didn't come easily as the first few attempts only revealed that the center of gravity (CG) was off and that the airframe can really take a beating while performing cartwheels, nose plants, tail flops, and many other "scare-o-batics" that it went through with surprisingly little damage. After some refinements and a correct CG placement, the model is now stable yet responsive and is a pure joy to fly. It can be hand-launched at half power, but retracts take the risk out of a bungled throw. The plane flies like a glider, even riding thermals with the power off. Since its drag coefficient is so low, it will glide around without power quite well. But be careful with landings as it tends to float by in ground effect, which uses up the entire runway.

Made out of blue foam carved and sanded to shape, the RQ-180 is easy to build.

My latest bird has retracts and automatic drag rudders using a Naze32 controller for yaw stability. Master builder and veteran U.S. Scale Masters flight judge Buz Hampton also built one as a prototype from the plans as they developed, and true to form, his turned out much better looking than mine.

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